DECLARATION

I, the undersigned, Takenori Suzuki, of c/o T. Kimura Patent Office, Sendai Building, 8-11, Minato 1-chome, Chuo-ku, Tokyo, Japan, do solemnly and sincerely declare:

1. That I am well acquainted with the English and Japanese languages and am competent to translate from Japanese into English.

2. That I have executed, with the best of my ability, a true and correct translation into English of the attached complete specification, claims, abstract and drawings originally filed as Japanese Patent Application No. 072742/1999 on 17 March 1999.

Dated this 24 August 2006

Takenori Suzuki

【Name of document】 Specification

【Title of the invention】 Communication device of mobile unit

【Scope of claims】

【Claim 1】 A communication device of a mobile unit for communicating between a mobile unit and a terminal device, characterized in that detecting means for detecting internal parameters of the mobile unit is provided in said mobile unit, and when a detection output of said detecting means becomes a specified value, data related to the mobile unit is sent to said terminal device from said mobile unit.

【Detailed description of the invention】

【0001】

【Technical field to which the invention pertains】

The present invention relates to a communication device of a mobile unit for carrying out communications between a mobile unit, such as construction machine, and a terminal device.

【0002】

【Background art and problems to be solved by the invention】

For a mobile unit, especially a construction machine, data, such as travel location, service meter, amount of fuel, and engine speed, is required information from the standpoint of managing a vehicle.

【0003】 In the past, as a method for acquiring data related to this construction machine, maintenance personnel went out to the construction machine, and confirmed historical data written to the internal memory of the construction machine through visual inspection or downloaded the historical data by connecting a personal computer to the construction machine. Then, a plurality of construction machine was managed by storing data collected from a plurality of construction machine into the memory of a computer in the management section.

【0004】 However, because the collection of information was done by hand, the larger the number of construction machine, and the more remote their location, the more

complicated data collection became, detracting greatly from the efficiency of data collection work.

【0005】 Accordingly, as seen in Japanese Patent Application Laid-open No. 6-330539, attempts are being made to automatically acquire construction machine data using communication means without relying on man power

【0006】 The invention disclosed in the above-mentioned publication is one that makes a connection between a management section and construction machine for unfettered two-way communications via communication means, and a data request is sent from the management section, data is extracted by the construction machine, and sent back to the management section. In this manner, the data of the construction machine side is collected at the requesting management section. Consequently, construction machine data can be obtained by a terminal of the management section side.

【0007】 Further, an error code is automatically sent to a management section terminal from the construction machine side when a serious malfunction occurs.

Here, it is desirable to be aware of an abnormal state occurring in construction machine (such as a robbery), which cannot be constantly managed and monitored by a terminal of the management side, and to accurately comprehend an operating state, and a resting state of construction machine, which cannot be constantly managed and monitored by a terminal of the management section side.

【0008】 However, according to the invention disclosed in the above-mentioned publication, such requirements cannot be handled.

【0009】 For example, it is supposed that data concerning the location of construction machine is to be acquired.

【0010】 According to the invention disclosed in the above-mentioned publication, it is possible to acquire the location of construction machine on the management section side only when there is a request from the management section regarding construction machine. That is, the successive locations of construction machine cannot be acquired by the management section side unless a request is made from the management section. Thus, when the management section does not request location data, if construction machine is

moved illegally (such as being stolen), it is not possible to deal with this in an opportune fashion. Further, just automatically sending an error code from the construction machine side does not make it possible to deal with an abnormal situation such as construction machine being moved illegally.

【0011】 In this manner, according to the invention disclosed in the above-mentioned publication, it is not possible to know about an abnormal state occurring in construction machine, which cannot be constantly managed and monitored. Further, it is not possible to accurately comprehend an operating state, and a resting state of construction machine, which cannot be constantly managed and monitored.

【0012】 The present invention has as an object making it possible to know about an abnormal state (such as robbery) occurring in a mobile unit, which cannot be constantly managed and monitored by the terminal side, and to accurately comprehend an operating state, and a resting state of a mobile unit.

【0013】

【Measure to solve the problems, and function and effect】

The present invention is, in a communication device of a mobile unit for communicating between a mobile unit and a terminal device, characterized in that detecting means for detecting internal parameters of the mobile unit is provided in said mobile unit, and when a detection output of said detecting means becomes a specified value, data related to the mobile unit is sent to said terminal device from said mobile unit.

【0014】 This invention will be explained by referring to Fig. 1 and Fig. 26.

【0015】 That is, communications are carried out between a mobile unit 31 and a terminal device 11 as shown in Fig. 1, and when instructions requesting mobile unit 31 data are sent to the mobile unit 31 from the terminal device 11, mobile unit 31 data is sent to the terminal device 11 from the mobile unit 31.

【0016】 Meanwhile, in the mobile unit 31, a mobile unit internal parameter, for example, the engine start-up state, is detected by detecting means (for example, a sensor for detecting an alternator voltage value).

【0017】 Then, when the detection output of detecting means constitutes a

specified value (state of engine at start-up) as shown in Fig. 26 (A), mobile unit information is sent to the terminal device 11 from the mobile unit 31 as shown in Fig. 26 (B).

【0018】 For example, it is supposed that mobile unit information, such as the location of construction machine or some other mobile unit 31, is to be acquired.

【0019】 According to this invention, even when there is no request for location data from the terminal device 11, the location of the mobile unit 31 is acquired by the terminal device 11 side when the engine is started up. Thus, even in a case in which the engine is started up at night, and the mobile unit 31 is moved illegally, since location data is acquired by the terminal device 11 side at that time, it is possible to deal appropriately with an abnormal situation. Further, even when location data is not requested from the terminal device 11 side, a location history of each time the engine is started is acquired by the terminal device 11 side, making it possible to accurately comprehend the operating states and resting states of the mobile unit 31.

【0020】 Therefore, according to this invention, even under conditions, wherein there is no request from the terminal device 11 side, since mobile unit information is acquired when a mobile unit 31 internal parameter constitutes a specified value, it is possible to perceive an abnormal situation that occurs in the mobile unit 31, which cannot be constantly monitored by the terminal device 11 side, and it is possible to accurately comprehend the operating states and resting states of the mobile unit 31.

【0021】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the fact that the engine of the above-mentioned mobile unit was started up, and when the above-mentioned engine is started up, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0022】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the fact that the engine of the above-mentioned mobile unit was started up, and when the above-mentioned engine is started up at a specified time or within a specified period of time, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0023】 Further, the invention is characterized in that the above-mentioned detecting means is detecting means for totaling the engine operating hours of the above-mentioned mobile unit, and when the total value of the above-mentioned engine operating hours either reaches a specified value, or increases by a specified amount, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0024】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the location of the above-mentioned mobile unit, and when the location of the above-mentioned mobile unit changes, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0025】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the speed of the above-mentioned mobile unit, and when the speed becomes equal to or higher than a specified value, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0026】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the relative location of the above-mentioned mobile unit for a set range, and when the relative location of the above-mentioned mobile unit for a set range constitutes a specified relative location, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0027】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the storage amount of data to be sent from e the above-mentioned mobile unit to the above-mentioned terminal device, and when the storage amount of data reaches a specified amount, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0028】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting the amount of fuel for the

above-mentioned mobile unit, and when the amount of fuel lowers below a specified amount, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0029】 Further, the present invention is characterized in that the above-mentioned detecting means is detecting means for detecting a drop in voltage of a power source mounted to the above-mentioned mobile unit, and when the voltage of the above-mentioned power source drops below a specified value, mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit.

【0030】 Further, the present invention is characterized in that mobile unit-related data is sent to the above-mentioned terminal device from the above-mentioned mobile unit only when the content of mobile unit-related data to be sent this time differs from the mobile unit-related data sent the previous time.

【0031】 Further, the present invention is characterized in that, by sending change data to the above-mentioned mobile unit from the above-mentioned terminal device, this change data is received by the above-mentioned mobile unit, and the above-mentioned mobile unit changes either a mobile unit internal parameter, or a specified value of the above-mentioned parameter in accordance with the received change data.

【0032】

【Embodiment of the invention】

Hereinbelow, aspects of the embodiment of a communication device of a mobile unit related to the present invention will be explained by referring to the figures. Furthermore, this embodiment supposes a system for managing vehicles peripheral to mobile work machine, such as mobile work machine (machines that travel to perform work, including hydraulic excavators, bulldozers, wheel loaders and other such construction machine), mobile work machine transport vehicles (trailers and the like for transporting mobile work machine), service vehicles (vehicles that travel for performing maintenance, inspections and other such services), special fueling and lubricating vehicles, and parts supply vehicles.

【0033】 Fig. 1 shows the overall constitution of the embodiment.

【0034】 As shown in Fig. 1, in the system of this embodiment, a plurality of mobile units 31, 32, 33, 34, 35 and a plurality of terminals 11, 12, 21, 22 are connected via communication means 1 (Internet 2, network control station 7, leased lines 3, satellite earth station 8, feeder lines 4, communication satellite 9, radio communication channel 5) to enable mutual transmitting and receiving.

【0035】 That is, construction machine and the like are often operated on a rental basis, and the precise work area is often unclear. And there are also times when this machine is taken overseas. In this embodiment, a communication network, which enables communications from anywhere on Earth, is used to cope with such problems. Furthermore, because a plurality of mobile units 31-35 are often found in groups, the plurality of mobile units 31-35 can also be connected via a prescribed communication means to enable them to communicate freely with one another.

【0036】 A plurality of mobile units 31-35 comprise mobile work machine, that is, construction machine 31, 32, 33, such as a bulldozer, hydraulic excavator, and crane, a service vehicle 34 for providing services like maintenance and inspections to this mobile work machine 31-33, and a mobile work machine transport vehicle, that is, a trailer 35 for transporting this mobile work machine 31-33.

【0037】 Terminals 11, 12, and so forth, are terminal devices (workstations) connected to the Internet 2. More specifically, computers, such as personal computers, are connected to the Internet via public telephone lines in a freely communicating condition. Furthermore, the Internet is a global communication network connecting a plurality of LANs (local area networks) via gateways and bridges in a freely communicating condition. The Internet 2 provides services, such as WWW (World Wide Web: an information retrieval system on the Internet) and e-mail (electronic mail: (letters) sent and received via the Internet).

【0038】 Terminals 11, 12, and so forth are installed in the offices of managers, who monitor and manage a plurality of mobile units 31-35, onboard a service vehicle 34, onboard a mobile work machine transport vehicle 35, in the offices of the users of the mobile work machine 31-33, and either in the mobile work machine 31-33 sales offices or business offices.

【0039】 Terminal 21 is a server terminal provided corresponding to terminals 11, 12, and so forth, and is connected to the Internet 2. Server terminal 21 comprises a database, that is, storage means. Therefore, server terminal 21, in response to requests from terminals 11, 12, provides content stored in a database to these terminals 11, 12.

【0040】 Terminal 22 is a server terminal provided corresponding to terminals other than terminals 11, 12.

【0041】 The server terminals 21, 22 function as mail servers for providing e-mail services, and, in addition, function as HTTP (hypertext transfer protocol) servers for providing WWW services. In other words, a mail server performs processing such that data sent from a request-origination terminal is sent to the address specified in an e-mail address. And a HTTP server displays a homepage as a file described in HTML (hypertext markup language) on the display device of a request-origination terminal in response to a request from the request-origination terminal. A homepage (an Internet information screen) is displayed using a WWW browser as data display software. These e-mail data and homepage data are stored in the databases of the server terminals 21, 22.

【0042】 A network control station 7 is connected in a freely communicating condition to the Internet 2.

【0043】 The network control station 7 and a satellite earth station 8 are interconnected in a freely communicating condition by a wire leased line 3. Over this leased line 3, data is transmitted at a speed of 64kbps.

【0044】 The satellite earth station 8 and a communication satellite 9 are interconnected in a freely communicating condition by a wireless feeder line 4. Over this feeder line 4, data is transmitted at a speed of 56kbps.

【0045】 The communication satellite 9 and the plurality of mobile units 31-35 are interconnected in a freely communicating condition by wireless communication channels 5. The reason for using satellite communications as wireless communications here is because construction machine and other such mobile units often operate in mountainous areas, forested regions, and remote places, and it is required to ensure communications with a mobile unit even in these mountainous and other areas, which are

incapable of being covered by ground wave communications. Further, if satellite communications are used, it becomes possible to manage and track construction machine even when it is taken overseas.

【0046】 E-mail is sent and received on the Internet 2 in accordance with a communication protocol called TCP/IP (transfer control protocol/Internet protocol). For leased line 3, feeder line 4, and wireless communication channel 5, electronic mail is sent and received in accordance with prescribed communication protocols that differ from this. Protocol conversion is performed by network control station 7.

【0047】 The location of a mobile unit 31-35 is measured via GPS (global positioning system). GPS satellites 41, 42 form a GPS. That is, radio waves sent from GPS satellites 41, 42 are received by a receiver mounted to a mobile unit 31-35, and based on the time difference of the sending time at the GPS satellites 41, 42 and the receiving time at the receiver, the pseudo-distance from the GPS satellites 41, 42 to the receiver is determined, and by making corrections thereto, the actual distance is computed, and the two-dimensional location of a receiver (a mobile unit 31-35) on the Earth is measured from this actual distance.

【0048】 Computer input devices (mouse, trackball, keyboard and so forth) are provided on the terminals 11, 12 and the server terminals 21, 22, and, in addition, display devices, which constitute liquid crystals, CRT and the like, are provided. A display screen of this display device will be explained below.

【0049】 Fig. 2 is a block diagram showing the constitutions of mobile units 31-35. In Fig. 2, mobile work machine 31 is shown to represent them.

【0050】 As shown in this Fig. 2, the inside of the vehicle body 50 of mobile work machine 31 is comprised of a satellite communication antenna 58 for sending and receiving data related to e-mail to and from communication satellite 9; a communication terminal 56 for processing the sending and receiving of e-mail to and from the communication satellite 9; a GPS antenna 59 for receiving radio waves sent from the GPS satellites 41, 42; a GPS sensor 57 for detecting the present location of mobile work machine 31 based on radio waves received from GPS satellites 41, 42; a camera 60, which is mounted in the upper portion of the cabin of the vehicle body 50, and which images the outside of the vehicle

body 50; a camera drive mechanism 61 for driving the camera 60 and adjusting the imaging direction, zoom and so forth; a car navigation system 55; a communication controller 54, which is connected such that signals are transferred between the communication terminal 56, GPS sensor 57, camera 60, and car navigation system 55; and an electronic control controller 53 and various other such controllers provided in each portion of the inside of vehicle body 50. Furthermore, a car navigation system is a system for displaying the current location of the vehicle detected via a GPS sensor on a map of a display screen. The car navigation system 55 is provided in the service vehicle 34 and the mobile work machine transport vehicle 35. In this case, the car navigation system 55 functions as terminals 13, 14 on a par with terminal 11 and terminal 12. Thus, as will be explained below, on a display screen of the car navigation system 55, the location of the vehicle itself is displayed and, in addition, the mobile work machine location, which constitutes the place where work is to be performed, is displayed, and an efficient travel route to the work site is set.

【0051】 Communication controller 54 is connected in daisy-chain fashion to electronic control controller 53 and the various other controllers via a signal wire 52 so as to enable serial communications, constituting an in-vehicle network 51.

【0052】 That is, a frame signal of a predetermined protocol is transferred over signal wire 52. When a frame signal is transmitted to the respective controllers 53, 54 and the like, a drive signal is outputted to an actuator (hydraulic pump, governor, control valve, and the like) connected to the respective controllers 53, 54 and the like, and these actuators are driven and controlled in accordance with data described in the frame signal, and, in addition, detection data detected by a sensor connected to the respective controllers 53, 54 and the like, or data indicating information inside the machine is acquired and described in a frame signal.

【0053】 A group of sensors 62 for detecting information related to a mobile unit, such as engine speed, battery voltage, fuel quantity, cooling water temperature, and abnormalities (error codes) (this is called mobile unit information), is connected to electronic control controller 53. Therefore, data related to mobile unit information detected by this group of sensors 62 is described in a frame signal, and sent to the communication controller 54 via the signal wire 52.

【0054】 Location data detected by the GPS sensor 57 is captured to the communication controller 54, and, in addition, image data imaged by the camera 60 is captured. Further, the communication controller 54 generates a drive command for a camera drive mechanism 61, and operates the camera drive mechanism 61 and adjusts the imaging direction and zoom of the camera 60 by outputting this drive command to the camera drive mechanism 61. Location data of a mobile unit 31 detected by this GPS sensor 57 and image data of the outside of the vehicle body 50 acquired by the camera 60 is comprised in the above-mentioned "mobile unit information."

【0055】 The communication terminal 56 performs processing for interpreting the content of e-mail received by satellite the communication antenna 58 from the terminals 11, 12, and thereafter, for preparing the content of a reply e-mail corresponding to the content of this request, and returning this e-mail.

【0056】 That is, the mobile unit information detected by the sensor group 62 of the electronic control controller 53, and the mobile unit information detected by the GPS sensor 57 and imaged by the camera 60, are sent to the communication terminal 56 from the communication controller 54, and incorporated into a reply e-mail according to the content of the request of the e-mail that had been sent.

【0057】 Further, display data corresponding to the content of the work instructions of the e-mail that had been sent is sent to the car navigation system 55 from the communication controller 54, and displayed on a display screen.

【0058】 Now then, e-mail addresses specific to the terminals 11, 12 are assigned to these terminals 11, 12, respectively. Further, e-mail addresses, which specify the mobile units 31-35, are assigned to these mobile units 31-35, respectively.

【0059】 In server terminal 21, the content of e-mail sent to these mobile units 31-35 from the terminals 11, 12 corresponding to the respective e-mail addresses of mobile units 31-35 is stored in the respective mailboxes. The server terminal (mail server) 21 searches the respective mailboxes of each of the mobile units 31-35, and sends data to the effect that it requests that the corresponding mobile units 31-35 come and pick up the e-mail inside their mailboxes. The mobile units 31-35, which receive this data, send data to the

server terminal 21 to the effect that they will receive the e-mail inside the corresponding mailbox. As a result of this, e-mail is sent to the respective mobile units 31-35 from the server terminal 21.

【0060】 Similarly, the content of e-mail sent back to the terminals 11, 12 from the mobile units 31-35 corresponding to the respective e-mail addresses of these terminals 11, 12 is stored in the respective mailboxes. The server terminal (mail server) 21 searches the respective mailboxes of each of the terminals 11, 12, and sends data to the effect that it requests that corresponding terminals 11, 12 come and pick up the e-mail inside their mailboxes. The terminals 11, 12, which receive this data, send data to the server terminal 21 to the effect that they will receive the e-mail inside the corresponding mailbox. As a result of this, e-mail is sent to the respective terminals 11, 12 from the server terminal 21.

【0061】 A communication status information extraction program, which acquires information on the transmission status of e-mail sent to the respective mobile units 31-35 from the respective terminals 11, 12, and the reply status of e-mails sent back to the respective terminals 11, 12 from the respective mobile units 31-35, is stored in the server terminal 21. By executing this communication status information extraction program, communication status information data, which indicates current communication status information, is generated.

【0062】 Further, a mobile unit information extraction program, which searches the respective mailboxes of each terminal 11, 12, and extracts mobile unit information from the content of e-mails sent back to the respective terminals 11, 12, is stored in the server terminal 21. By executing this mobile unit information extraction program, total mobile unit information MD, which indicates the latest information for all the mobile units, is generated. This total mobile unit information MD is data on content corresponding to the latest mobile unit information of each of the mobile units 31-35.

【0063】 Here, a homepage for managing and monitoring the mobile units 31-35 is prepared on the server terminal 21, and stored in the database as prescribed link structure data. Respective homepage display screens are shown in Fig. 27 through Fig. 32. Furthermore, in this specification, a homepage is defined as a generic term for a series of linked pages that follow a first page.

【0064】 A homepage update processing program, which updates data of a display screen corresponding to the homepage in accordance with the above-mentioned communication status information data and total mobile unit information MD, is stored in server terminal 21. By executing this homepage update processing program, mobile unit information of the display screen corresponding to the homepage is updated in accordance with the latest total mobile unit information MD stored in the server terminal 21, and, in addition, communication status information of the display page corresponding to the homepage is updated in accordance with the current communication status information stored in the server terminal 21. Furthermore, with regard to time sequence data (such as the fuel quantity time sequence data shown in Fig. 29), the latest data is added, and, in addition, the oldest data is deleted.

Next, the operation of this embodiment will be explained.

【0065】 It is supposed that terminal 11 is a terminal installed on the side, for example, of the manager of the mobile units 31-35.

【0066】 When a WWW browser is started up at this management side terminal 11, homepage data is read out from the server terminal 21 via the WWW browser, and displayed in a display screen of the display device of terminal 11.

【0067】 Fig. 27 shows a map display screen of the homepage displayed on the display device of terminal 11. This map data is stored in the computer of terminal 11. As shown in Fig. 27, icons (pictographs), which specify the respective mobile units 31-35, are respectively superimposed and displayed on a map. Since the mobile units 31-35 are displayed as icons, the types of mobile units 31-35 (bulldozer, hydraulic excavator, wheel loader, trailer, service vehicle) can be easily distinguished on the screen. The location of an icon on the map corresponds to the latest mobile unit location detected by the GPS sensor 57 inside each of the mobile units 31-35 and stored in the database of the server terminal 21.

【0068】 When an input operation (key operation, or click operation) for sequentially moving the homepage display screen to the next page is performed via an input device of terminal 11, it is possible to sequentially move from the current screen to the next display screen. In this case, by performing a click input operation on the icon of that mobile unit to be displayed (for example, mobile work machine 31) from among the icons

of the respective mobile units 31-35 displayed on the display screen, it is possible to move to a display screen, which shows detailed information of only that mobile work machine 31 to be displayed.

【0069】 For example, Fig. 31 is a display screen, which displays a table of information of all the mobile units 31-35.

【0070】 When a click input operation is performed on the icon of a mobile unit (for example, mobile work machine 31), for which detailed information is to be displayed on the display screen shown in Fig. 31, the display moves to the display screen shown in Fig. 28, and the latest mobile unit information related to the specified mobile work machine 31 is displayed on the display screen. By doing the same thing from the map display screen of all the mobile units 31-35 shown in Fig. 27, it is also possible to move to a display screen, which shows the detailed mobile unit information of the specified mobile unit shown in Fig. 28.

【0071】 Fig. 28 shows a screen for displaying the latest data of individual types of machine.

【0072】 As shown in this Fig. 28, mobile unit information, such as the current location, service meter values, fuel quantity, engine speed, engine cooling water temperature, battery voltage, hydraulic pump outlet pressure, oil quantity, abnormalities (error codes), and camera images of a specified mobile unit (for example, mobile work machine 31), is displayed. For example, when mobile work machine 31 is performing excavation work on a mound 116 as shown in Fig. 6, the excavation status of the mound 116 is imaged by the camera 60. As a result of this, as shown in Fig. 28, an image of this mound 116 is displayed on the display screen of terminal 11. Thus, it is possible to visually grasp the state of work progress of the remote mobile work machine 31 from terminal 11.

【0073】 When a click input operation is performed on a button for specified mobile unit information, for example, a fuel quantity "graph," for which time sequence data is to be displayed on the display screen shown in Fig. 28, the display moves to the display screen shown in Fig. 29, and a graph showing time-sequenced changes in fuel quantity is displayed on the display screen.

【0074】 Further, when a click input operation is performed on the operation map button on the display screen shown in Fig. 28, the display moves to the display screen shown in Fig. 30, and the daily operating time (engine operating time) of mobile work machine 31 is displayed as a band graph. Thus, the manager can easily comprehend the rate of operation (productivity) of the specified mobile work machine 31 from the operation map displayed in this Fig. 30.

【0075】 Further, by doing the same thing, it is possible to display time-sequenced data of abnormalities (error codes), that is, a history of abnormal occurrences, of mobile work machine 31 on a display screen. Thus, it is possible to make a determination from a past history of abnormal occurrences, and to take appropriate measures relative to newly generated abnormalities. Further, since the content of abnormal occurrences can be accurately and rapidly recognized from the terminal 11 side, these abnormalities can be dealt with by a small number of people without having to dispatch expert technicians to the field.

【0076】 Next, the content of processing when requesting the latest mobile unit information for a specified mobile unit from the homepage display screen of terminal 11 will be explained.

【0077】 In this case, a click operation is performed on the icon of that mobile unit (for example, mobile work machine 31) for which the latest mobile unit information is being requested from among all the mobile units 31-35 on the display screen shown in either Fig. 31 or Fig. 27. In accordance therewith, request destination identification data D2 for the content of "mobile unit 31" is generated.

【0078】 Next, by performing an input operation to switch display screens, the display screen switches to the request execution display screen shown in Fig. 32.

【0079】 Then, out of the checkboxes indicating each item of the mobile unit information shown in Fig. 32, that is, "vehicle location," "service meter," "fuel quantity," "work mode," "vehicle warning 1 (error code 1)," "vehicle warning 2 (error code 2)," "battery voltage," "engine water temperature," "engine speed," "pump pressure," "oil quantity," and "camera images," a click operation is performed on the item to be requested.

In accordance therewith, the mobile unit information to be requested (for example, "vehicle location," "fuel quantity") is selected from among all the mobile unit information of mobile work machine 31, and requested information identification data D3 for the content of "vehicle location" and "fuel quantity" are generated. Thus, mobile unit information basic to managing the rate of operation, such as vehicle location and service meter, can, of course, be requested via an input device of terminal 11, and mobile unit information required for maintenance and inspections, such as fuel quantity, and battery voltage, can also be arbitrarily selected and requested. Furthermore, with regard to the imaging direction and zoom of the camera 60 as well, the camera drive mechanism 61 can be operated and adjustments made by input operations at terminal 11.

【0080】 However, the volume of data communications increases as the amount of data of the mobile unit information being requested becomes larger, increasing communication status costs. Accordingly, to inform a terminal 11 requester of communication status charges and make him aware of the economical efficiency, the amount of data to be sent and received is displayed at the stage when a mobile unit information item is selected. More specifically, in addition to "current number of bytes," numerical values for "number of bytes transmitted," "number of bytes received" and "number of bytes billed this month" are displayed. Furthermore, the communication status charges themselves can be displayed in place of the volume of communication status data.

【0081】 Further, from among the respective checkboxes of each terminal of the reply destination terminals shown in Fig. 32, that is, "manager A (terminal 11)," "manager B," "service vehicle," and "trailer (terminal 12)," a click operation is performed on the terminal of the display destination, where mobile unit information is to be displayed. In accordance therewith, a display destination terminal (for example, terminal 12) is selected from among the respective terminals 11, 12 and so forth, and display destination identification data D4 for the content of "terminal 12" is generated. It is supposed that terminal 12 is a terminal provided at the operator side of mobile work machine transport vehicle (trailer) 35.

【0082】 Fig. 33 shows a sequence diagram of processing procedures for communication status control. Hereinbelow, an explanation will be given by referring to

this figure.

【0083】 When there is an input operation for the above-mentioned data by a request-origination terminal 11 to the server terminal 21, requester identification data D1 indicating the request-origination terminal (terminal 11), request destination identification data D2 indicating the mobile unit to which a request is being sent (mobile work machine 31), requested information identification data D3 indicating the content of the information being requested (vehicle location, fuel quantity), and display destination identification data D4 indicating the terminal on which the requested information is to be displayed (terminal 12) are sent to the server terminal 21 from terminal 11 as e-mail using a data structure conforming to a communication status protocol on the Internet 2. Here, requester identification data D1 ("terminal 11") corresponds to the e-mail address of request-origination terminal 11. Further, display destination identification data D4 ("terminal 12") corresponds to the e-mail address of display destination terminal 12. Further, request destination identification data D2 ("mobile work machine 31") corresponds to the e-mail address of the mobile work machine 31.

【0084】 The server terminal 21 receives the sent e-mail, reads in the request destination identification data D2, and stores the content of the e-mail in the mailbox of the mobile work machine 31, which corresponds to this request destination identification data D2 ("mobile work machine 31").

【0085】 The server terminal (mail server) 21 transmits data to mobile work machine 31 to the effect that it requests that mobile work machine 31 come to pick up the e-mail inside its mailbox. That is, a response-requested signal is sent via radio communication status channel 5 to mobile work machine 31 from the communication status satellite 9. The transmission of this response-requested signal to mobile work machine 31 from the communication status satellite 9 side is carried out continuously since often times it is not clear whether or not communication is possible, such as when mobile work machine 31 is in an environment, where communication status conditions are not good. In response thereto, confirmation of the existence of a response-requested signal is performed intermittently from the mobile work machine 31 side to the communication status satellite 9. Confirmation of the existence of a response-requested signal is performed by sensing a

radio wave indicating that a response-requested signal has been sent from the communication status satellite 9. Therefore, a request can be reliably communicated from the communication status satellite 9 side to mobile work machine 31. The confirmation of the existence of this response-requested signal (sensing of a radio wave indicative of a response-requested signal) is performed either at the time at which a specific event occurs, or subsequent to the passage of a predetermined amount of time following the occurrence of a specific event.

【0086】 For example, the starting up of the engine of mobile work machine 31 can be detected, and this detection signal can serve as the trigger for confirming the existence of a response-requested signal. In this case, confirmation of the existence of a response-requested signal can be performed only when the engine is initially started up each day.

【0087】 Further, the occurrence of an abnormality in mobile work machine 31 can be detected, and this detection signal can serve as the trigger for confirming the existence of a response-requested signal.

【0088】 Further, confirmation of the existence of a response-requested signal can be performed when a predetermined amount of time has passed following the carrying out of the last transmission by mobile work machine 31, and the next transmission can be performed.

【0089】 Further, either the above-mentioned specific event or predetermined time can be arbitrarily altered. It may be constituted such that these items are changed by an input operation to an input device of terminal 11.

【0090】 As a result of the above-mentioned confirmation of the existence of a response-requested signal, when a response-requested signal is deemed to exist, mobile work machine 31 sends to the server terminal 21 via the communication status satellite 9 data to the effect that it will take delivery of the e-mail inside its mailbox. As a result thereof, e-mail is sent to mobile work machine 31 from the server terminal 21.

【0091】 That is, the e-mail is sent to network control station 7 via the Internet 2, and the e-mail data undergoes protocol conversion. Then, the protocol-converted e-mail if

sent out over a leased line 3. And then the e-mail is sent to mobile work machine 31 via the satellite earth station 8, feeder line 4, communication status satellite 9, and radio communication status channel 5, and is received by the satellite communication status antenna 58 of mobile work machine 31.

【0092】 The communication terminal 56 of mobile work machine 31 reads in the requested information identification data D3 ("vehicle location," "fuel quantity") from the e-mail received via the satellite communication status antenna 58, and instructs the communication status controller 54 to acquire mobile unit information corresponding to this requested information identification data D3, in other words, vehicle location data and fuel quantity data, from inside this mobile work machine 31.

【0093】 In response to this, the communication status controller 54 sends vehicle location data, which is currently being detected by the GPS sensor 57, to the communication terminal 56. Further, data to the effect that "fuel quantity" should be acquired by the electronic control controller 53 is described in a frame signal and sent out over the signal wire 52. The electronic control controller 53 reads in the description content of the frame signal, collects detection data on the current fuel quantity from the sensor group 62 of this electronic control controller 53, and describes same in a frame signal. Then, this frame signal is sent to the communication status controller 54 via the signal wire 52. The communication status controller 54 reads out the fuel quantity data described in the frame signal, and sends same to the communication terminal 56. As a result of this, the communication terminal 56 incorporates the vehicle location data and fuel quantity data into a reply e-mail as mobile unit information D3'.

【0094】 Reply originator identification data D2 (mobile work machine 31) indicating the mobile unit from which the reply originated, reply destination identification data D4 (terminal 12) indicating the terminal to which the reply is sent, and mobile unit information D3' (vehicle location data and fuel quantity data) indicating the mobile unit information is sent from the communication terminal 56 via the satellite communication status antenna 58 to the communication status satellite 9 as a reply e-mail using a data structure that conforms to a prescribed communication status protocol. Furthermore, D1 and D3 are sent simultaneously. D1 can be used as a distribution key for each

communication status charge billing destination. Further, D3 is used in identifying the content of D3'. Here, reply originator identification data D2 ("mobile work machine 31") corresponds to the e-mail address of mobile work machine 31. Further, reply destination identification data D4 ("terminal 12") corresponds to the e-mail address of the display destination terminal 12.

【0095】 The reply e-mail is received by the communication status satellite 9, and then sent to the network control station 7 via the feeder line 4, satellite earth station 8 and leased line 3. The data of the reply e-mail undergoes protocol conversion at this network control station 7, and the protocol-converted reply e-mail is sent out over the Internet 2.

【0096】 The server terminal 21 receives the sent e-mail, reads in the reply destination identification data D4, and stores the content of the e-mail in the mailbox of the terminal 12, which corresponds to this reply destination identification data D4 ("terminal 12").

【0097】 Furthermore, the above-mentioned mobile unit information extraction program is executed, mobile unit information D3' ("vehicle location data," and "fuel quantity data") is extracted from the content of the e-mail stored in the terminal 12 mailbox, and, in addition, reply originator identification data D2 ("mobile work machine 31") is extracted, and the latest vehicle location data and fuel quantity data are stored correspondent to the address of mobile work machine 31. In this manner, the contents of the total mobile unit information are updated.

【0098】 The server terminal (mail server) 21 sends to terminal 12 data to the effect that it requests that terminal 12 come pick up the e-mail in its mailbox. In response to this, terminal 12 sends to the server terminal 21 data to the effect that it will take delivery of the e-mail in its mailbox. As a result of this, the e-mail is sent from the server terminal 21 to terminal 12. The data to be sent can be limited by the security layer of D4.

【0099】 When the e-mail is received by operator-side terminal 12 of the mobile work machine transport vehicle 35, reply originator data D2 (mobile work machine 31) and mobile unit information D3' (vehicle location data and fuel quantity data) are read out from the data of the e-mail. When this happens, the content of the e-mail, that is, the current location and current fuel quantity of mobile work machine 31, are displayed on a display

screen of terminal 12.

【00100】 Thus, the operator of transport vehicle 35 can perceive from the display screen of terminal 12 the specific type of mobile work machine 31 about which transportation instructions have been issued by the management side, and, in addition, can also perceive the current location and current fuel quantity, which are required for transporting this mobile work machine 31. Moreover, for the operator of the side of terminal 12, it is possible to obtain from the terminal 12 display screen only that information required for work without having to perform an information request input operation. In other words, an operator, who wants to obtain information, can obtain information required for work even under conditions in which it is not possible to perform an input operation via terminal 12. Thus, the work of transporting mobile work machine 31 can be carried out extremely efficiently.

【00101】 Furthermore, the embodiment described hereinabove is constituted such that information needed for transportation is displayed on operator-side terminal 12 of the transport vehicle 35 by a request input operation performed at the management-side terminal 11, but there is also the possibility of an embodiment, such that information required for services, like maintenance and inspections, is displayed on the terminal 12 of the side of a serviceman, who is driving a service vehicle 34, by a request input operation performed at the management-side terminal 11.

【00102】 In this case, similarly, an email, which treats the current location data, service meter and abnormal data of mobile work machine 31 as mobile unit information, is sent from the management-side terminal 11 to the terminal 12 of the serviceman side via the mobile work machine 31.

【00103】 When the e-mail is received by the serviceman-side terminal 12, reply originator data D2 (mobile work machine 31) and mobile unit information D3' (vehicle location data and abnormal data (error code)) are read out from the data of the e-mail. When this happens, the content of the e-mail, that is, the current location and current abnormal occurrence item (error code) of mobile work machine 31, are displayed on the display screen of the terminal 12.

【00104】 Thus, the serviceman driving the service vehicle 34 can perceive from

the display screen of the terminal 12 the specific type of mobile work machine 31 about which service instructions have been issued by the management side, and, in addition, can also perceive the current vehicle location and current abnormal occurrence item (error code), which are required for servicing this mobile work machine 31. Moreover, for the serviceman of the side of terminal 12, it is possible to obtain from the terminal 12 display screen only that information required for work without having to perform an information request input operation. In other words, a serviceman, who wants to obtain information, can obtain information required for work even under conditions in which it is not possible to perform an input operation via terminal 12. Thus, the work of providing maintenance and inspection of the mobile work machine 31 can be carried out extremely efficiently.

【00105】 Next, it is supposed that the terminal of the management side is server terminal 21.

【00106】 In this case, by performing a request input operation via the terminal 12 of the side of a serviceman, who is driving a service vehicle 34, it is possible to display information required for the centralized management of a plurality of mobile units on the management-side server terminal 21. For example, when a serviceman supplies oil to mobile work machine 31, since the on-site serviceman himself is cognizant of the fact that sufficient oil has been supplied, there is no need for him to confirm this fact all over again via the terminal 12 display screen. On the other hand, it is necessary to provide information to the management side as to the fact that oil supply work has been completed, and for managing the next oil supply period.

【00107】 Similarly, in this case, too, an email, which treats the current oil quantity data of mobile work machine 31 as mobile unit information, is sent from serviceman-side terminal 12 to server terminal 21 via mobile work machine 31.

【00108】 When the e-mail is received by server terminal 21, reply originator data D2 (mobile work machine 31) and mobile unit information D3' (oil quantity data) are read out from the data of the e-mail. When this happens, the content of the e-mail, that is, the current oil quantity of mobile work machine 31, are displayed on the display screen of server terminal 21.

【00109】 Thus, the manager can perceive from the display screen of server

terminal 21 the specific type of mobile work machine 31 for which an oil supply service has been completed, and, in addition, can also perceive the current oil quantity, which is required for managing this mobile work machine 31. Moreover, for the manager of the side of server terminal 21, it is possible to obtain from the server terminal 21 display screen only that information required for management without having to perform an information request input operation. In other words, a manager, who wants to obtain information, can obtain information required for managing a mobile unit even under conditions in which it is not possible to perform an input operation via the server terminal 21 side. Thus, the work of centrally managing mobile work machine 31-35 can be carried out extremely efficiently.

【00110】 In the embodiment described hereinabove, the terminal of the request originator and the terminal of the display destination are different, but the terminal of the request originator and the terminal of the display destination can be the same.

【00111】 For example, by performing a request input operation via the operator-side terminal 11 of mobile work machine 31, it is possible to display information required for start-up inspection on the same screen. The operator of mobile work machine 31 performs the above-mentioned request input operation via terminal 11 inside the office before getting into the vehicle.

【00112】 Similarly, in this case, too, an email, which treats the current fuel quantity and the current oil quantity data of mobile work machine 31 as mobile unit information, is sent from terminal 11 to terminal 11 via mobile work machine 31.

【00113】 When the e-mail is received by terminal 11, reply originator data D2 (mobile work machine 31) and mobile unit information D3' (fuel quantity data, and oil quantity data) are read out from the data of the e-mail. When this happens, the content of the e-mail, that is, the current fuel quantity and current oil quantity of mobile work machine 31, are displayed on the display screen of terminal 11.

【00114】 Thus, the mobile work machine operator can perceive from the terminal 11 display screen the current fuel quantity and oil quantity required for a start-up inspection of the specified type of mobile work machine 31, which he is about to get into. In this case, for the operator of the side of terminal 11, it is possible to obtain beforehand from the display screen of terminal 11 only that information necessary for a start-up inspection

without having to actually go to mobile work machine 31. Thus, a start-up inspection of mobile work machine 31 can be performed easily and efficiently, and any inadequacies discovered via the start-up inspection can be dealt with in advance.

【00115】 Similarly, by performing a request input operation via operator-side terminal 11 of mobile work machine transport vehicle 35, it is possible to display information required for transportation work on the same terminal 11. Thus, the operator of mobile work machine transport vehicle 35 can perceive from the display screen of terminal 11 the mobile unit information (current location, current fuel quantity, etc) required to transport the specific type of mobile work machine 31, which he intends to transport. In this case, for the operator of the side of terminal 11, it is possible to obtain beforehand from the terminal 11 display screen only that information necessary for transport work without having to actually go to mobile work machine 31. Thus, the job of transporting mobile work machine 31 can be performed easily and efficiently, and any inadequacies can be dealt with in advance.

【00116】 Similarly, by performing a request input operation via the serviceman-side terminal 11 of service vehicle 34, it is possible to display information required for services, such as maintenance and inspection, on the same terminal 11. Thus the serviceman of service vehicle 34 can perceive from the display screen of terminal 11 the mobile unit information (current location, abnormal occurrences, service meter) required to service the specific type of mobile work machine 31, which he intends to service. In this case, for the serviceman of the side of terminal 11, it is possible to obtain beforehand from the terminal 11 display screen only that information necessary for providing services without having to actually go to mobile work machine 31. Thus, the servicing of mobile work machine 31 can be performed easily and efficiently, and any inadequacies can be dealt with in advance. In other words, the serviceman can recognize an abnormal state before actually proceeding to mobile work machine 31, and can efficiently arrange for parts, call on support personnel for help and research repair methods.

【00117】 Further, according to this embodiment, it is possible to achieve an effect such that the latest total mobile unit information MD related to a plurality of mobile units 31-35, updated by request input operations from a plurality of terminals 11, 12, and so forth,

can be displayed on an arbitrary terminal (for example, terminal 11). This will be explained once again by referring to Fig. 33.

【00118】 That is, when a reply e-mail is sent from mobile work machine 31 to the server terminal 21 as described hereinabove, the mobile unit information extraction program is executed by the server terminal 21, and mobile unit information D3' ("vehicle location data," "fuel quantity data") is extracted from the content of the e-mail stored in the mailbox of the display terminal 12, and, in addition, reply originator identification data D2 ("mobile work machine 31") is extracted, and the latest vehicle location data and fuel quantity data are stored correspondent to the email address of the mobile work machine 31. In accordance therewith, the content of total mobile unit information MD is updated. In addition, the above-mentioned homepage updating program is executed on the server terminal 21, and mobile unit information of a display screen corresponding to the homepage is updated in accordance with the latest total mobile unit information MD stored in the server terminal 21. With regard to time sequence data (such as the fuel quantity time sequence data shown in Fig. 29), the latest data is added, and, in addition, the oldest data is deleted.

【00119】 Accordingly, when a WWW browser is started up on terminal 11, updated homepage data is read out from the server terminal 21 via the WWW browser. As a result of this, mobile unit information updated by the latest total mobile unit information MD is displayed on the display screen of the terminal 11 display device. In other words, when there is an input operation from the terminal 11 requesting the server terminal 21 for the latest total mobile unit information MD, the latest total mobile unit information MD is displayed on the display screen of the terminal 11.

【00120】 Now, it is supposed that the display shown in Fig. 27 is being displayed at terminal 11.

【00121】 When this happens, the icon of a mobile work machine 31 on the map shown in Fig. 27 is displayed by being switched to a location on the map corresponding to the latest (current) vehicle location data.

【00122】 Further, when the display switches to the display screen shown in Fig. 28, the numerical values for "location data" and the numerical values for "fuel quantity" on

the screen are displayed by being switched to the latest (current) numerical values for vehicle location data and numerical values for fuel quantity data, respectively. Further, when the display switches to the display screens shown either in Fig. 29 or Fig. 30, either a graph of changes in fuel quantity over time or an operation map are displayed by being converted to the latest one.

【00123】 As described hereinabove, according to this embodiment, it is possible to display the latest total mobile unit information MD related to a plurality of mobile units 31-35, updated in accordance with request input operations from a plurality of terminals 11, 12 and so forth, on the display screen of an arbitrary terminal 11. Thus, there is achieved an effect whereby the latest mobile unit information for a plurality of mobile work machine 31-35 can be acquired via an arbitrary terminal, enabling the management and monitoring of all mobile units. That is, it becomes possible to centrally manage via an arbitrary terminal the latest mobile unit information related to a plurality of mobile work machine 31-35, requested by a plurality of requesters.

【00124】 In this embodiment, databases are provided in each of server terminals 21, 22, and total mobile unit information MD is stored separately. Accordingly, by transmitting the stored data (total mobile unit information MD) of the database of the server terminal of the one side to the database of the other server terminal, it is possible to make shared use of total mobile unit information via the other server terminal database as well, and the stored content (total mobile unit information MD) of the databases of the respective server terminals can be made the same content. More specifically, this is achieved by a method, wherein e-mail (describing mobile unit information) sent back to the server terminal of the one side is automatically transmitted to the other server.

【00125】 Now then, as mentioned above, a terminal 13 equivalent to terminal 11 and terminal 12 is mounted in the service vehicle 34, and the functions of the car navigation system 55 are incorporated into this terminal 13 and operated.

【00126】 An embodiment, wherein work instructions are provided to a serviceman by sending work instruction data from the management-side terminal 11 to terminal 13 disposed in the service vehicle 34, will be explained hereinbelow. Servicemen often perform repairs, parts replacement and inspection work in the field, and have few

opportunities to communicate directly with a manager. If the system of this embodiment is put to use, it is possible to receive work instructions efficiently since no limitations are placed on the time and place for receiving work instructions.

【00127】 E-mail, which treats terminal 13 mounted in the service vehicle 34 as the display destination terminal (display destination identification data D4), and mobile work machine 31 as the request destination mobile unit (request destination identification data D2), and to which the respective data of a message stating "Failure E occurred, rush to site," is added, is sent from the management-side terminal 11 via the same operation as was explained in Fig. 33. Here, the message data stating "Failure E occurred, rush to site" is added to the e-mail by performing an input operation via a terminal 11 input device.

【00128】 Thus, as shown in Fig. 3, on the display screen 13a of service vehicle 34 terminal 13, which is the display destination terminal, the icon of a mobile work machine 31, which is the unit to be serviced, is displayed in the latest (current) location on the map, and, in addition, the icon of the service vehicle 34 itself is displayed in the current location on the map. Furthermore, the current location of the vehicle 34 itself is detected by the GPS sensor 57, which is mounted in the vehicle 34 itself, and displayed on screen 13a. In addition, in the message portion 103 of the display screen of terminal 13, the message ("Instruction message: Failure E occurred, rush to site") sent in the e-mail is displayed.

【00129】 In accordance therewith, the serviceman riding in the service vehicle 34 can perceive from display screen 13a the fact that his next unit to be serviced (destination) is mobile work machine 31, and a message related to the current location and the job details thereof. Further, an automatic route generation program is stored in terminal 13. With this automatic route generation program, when the current location of the service vehicle 34 and the destination (current location of mobile work machine 31) are provided, processing for automatically generating the shortest travel route on the map is performed. Therefore, when this automatic route generation program is executed, the shortest travel route 102 from the current location of the service vehicle 34 to the current location of mobile work machine 31, which is the destination, is displayed on display screen 13a of terminal 13.

【00130】 Consequently, it is possible for the serviceman to move service vehicle 34 and perform work at the destination in accordance with display screen 13a of terminal

13.

【00131】 If it is possible to perform work according to the content of the work instructions, a click operation is performed on button 110 indicating "OK" on display screen 13a. Further, when the service vehicle 34 arrives at the destination, and work is started, a click operation is performed on button 113 indicating "Arrival" on display screen 13a. Further, when service work on mobile work machine 31 has been completed, a click operation is performed on button 112 indicating "Finished" on display screen 13a. Further, when work according to the content of the work instructions cannot be undertaken for some reason, a click operation is performed on button 111 indicating "Suspended" on display screen 13a. The content of input operations resulting from these click operations on terminal 13 is sent to the management-side terminal 11 from terminal 13 via e-mail. By receiving this e-mail at terminal 11, it is possible to comprehend the state of work progress of service vehicle 34. Furthermore, in addition to touch operations, such as click operations, key operations, and touch-panel operations, input operations can also make use of voice input operations.

【00132】 In this manner, maintenance, inspection and other servicing is carried out extremely efficiently. According to this embodiment in particular, since the latest location of mobile work machine 31 is displayed on screen 13a, a serviceman can reliably move his own vehicle 34 without losing sight of the target even when the unit to be serviced 31 is moving around within the work area.

【00133】 In the above-described embodiment, the constitution is such that e-mail, which makes terminal 13 of the service vehicle 34 the display destination terminal, is sent from the management-side terminal 11, and the content shown in Fig. 3 is displayed on terminal 13, but it is possible for the content of Fig. 3 to be displayed on terminal 13 by procedures like those hereinbelow. That is,

1) Management-side terminal 11 sends e-mail, which treats its own terminal 11 as the display destination terminal (display destination identification data D4), and treats mobile work machine 31 as the request destination mobile unit (request destination identification data D2). In accordance therewith, the latest location of mobile work machine 31 is acquired by terminal 11.

【00134】 2) Terminal 11 sends to terminal 13 e-mail, which has as work instruction data the above-obtained current location of mobile work machine 31, and a message stating "Failure E occurred, rush to site."

【00135】 Further, it is also possible for the content of Fig. 3 to be displayed on terminal 13 by procedures like those hereinbelow. That is,

1) Terminal 11 sends to terminal 13 e-mail message data stating "Failure E occurred, rush to site."

【00136】 2) Terminal 13 starts up a WWW browser, and reads out updated homepage data from the server terminal 21 via the WWW browser. Thus, the latest location of mobile work machine 31 is displayed on a display screen of terminal 13 as the latest total mobile unit information MD.

【00137】 Now then, the mobile unit location and the content of work instructions data indicating the job details sent from the management-side terminal 11 are arbitrary. For example, as the details of a job, a full day's worth of job details can be specified. Here, by the management-side terminal 11 requesting the server terminal 21 for an operation map (Fig. 30) for service vehicle 34, it is possible to comprehend the daily rate of operation of service vehicle 34. Accordingly, by collating this daily rate of operation against a day's worth of job details directed to service vehicle 34 from the management side, it is possible to automatically and accurately prepare a daily work report.

【00138】 Further, not only the location of a unit to be serviced (location of mobile work machine 31) is sent from the management-side terminal 11 to terminal 13 of the service vehicle 34, but rather, the location of another service vehicle 34' can be sent as well. In accordance therewith, since the location of another service vehicle 34' is displayed on display screen 13a of service vehicle 34 terminal 13, traveling to and communicating with this service vehicle 34' is made easier, and service work can be performed even more efficiently. That is, it becomes possible to borrow tools, replacement parts, and the like from the other serviceman, and it also becomes possible to request assistance. Further, if it is an experienced serviceman, it is also possible to seek his advice.

【00139】 Further, in the above-described embodiment, data on the location of a

single mobile work machine 31 is sent to terminal 13 of the service vehicle 34 from the management-side terminal 11, but an embodiment, which is constituted so as to send the locations of a plurality of mobile work machine 31A, 31B, 31C, 31D, and which causes a service patrol of a plurality of mobile work machine 31A-31D to be carried out efficiently, is also possible.

【00140】 In this case, work instructions data containing the current locations of a plurality of mobile work machine 31A-31D, and the service meter increment values ("3H," "678H," "10H," and "500H") of each mobile work machine 31A-31D from the last patrol until the present are sent to terminal 13 of the service vehicle 34.

【00141】 In accordance therewith, on display screen 13a of service vehicle 34 terminal 13, the icons of the respective mobile work machine 31A-31D are displayed in their current locations on a map as shown in Fig. 5, and, in addition, the service meter increment values of the respective mobile work machine 31A-31D are displayed. Here, even when mobile work machine 31D has moved relative to its last location (indicated by dotted lines), its current location (indicated by solid line) is displayed on the map of screen 13a.

【00142】 Further, an automatic patrol route generation program is stored in terminal 13. With this automatic patrol route generation program, when the current location of the service vehicle 34 itself, and a plurality of candidate sites for patrol (mobile work machine 31A-31D) are provided, processing for selecting only those patrol candidate sites having service meter increment values larger than the setting value, and for automatically generating the most efficient patrol travel route for passing through these selected patrol candidate sites is performed. Accordingly, when this automatic route generation program is executed, a patrol travel route 108, which is indicated by solid lines going from the current location of the service vehicle 34 itself to the mobile work machine 31B, 31D, which have large service meter increment values ("678H," "500H"), and returning once again to the vehicle 34 itself, is displayed on display screen 13a of terminal 13.

【00143】 Accordingly, it is possible for a serviceman to perform a service patrol extremely efficiently by moving service vehicle 34 along the patrol travel route 108

indicated by solid lines, and performing work at each patrol site in accordance with display screen 13a of terminal 13. That is, in the past, if a fixed time had elapsed since the last service patrol, indicated by the dotted line in Fig. 5, patrol route 109, which goes to all the mobile work machine 31A-31B, was set indiscriminately, and work was performed on all the vehicles. By contrast, according to this embodiment, since work is performed by virtue of a patrol travel route 108, which avoids mobile work machine 31A, 31C, the operating hours for which have not increased since the last service patrol (service meter increment values "3H" and "10H"), futile work can be avoided.

【00144】 Furthermore, the patrol travel route 108, indicated by solid lines in Fig. 5, need not be generated automatically, but rather, can be set according to the judgment of a serviceman.

【00145】 Further, in the above-described embodiment, work instructions data is sent from the management-side terminal 11 to terminal 13 mounted in the service vehicle 34, but an embodiment, which causes transport loading work to be performed efficiently by sending work instructions data from the management-side terminal 11 to terminal 14 mounted in the mobile work machine transport vehicle 35, is also possible.

【00146】 In this case, e-mail comprising the respective data of the current location of mobile work machine 31, which is at the loading site, the location of the off-loading site 106, where the loaded vehicle will be off-loaded, and a message stating "Return When Finished" is sent to terminal 14 of the mobile work machine transport vehicle 35.

【00147】 In accordance therewith, on display screen 14a of terminal 14 of the transport vehicle 35, the icon of mobile work machine 31 is displayed in its current location on a map, and, in addition, the icon of off-loading site 106 is displayed in a corresponding location on the map as shown in Fig. 4. Furthermore, the current location of the transport vehicle 35 itself is detected by the GPS sensor 57 mounted in the transport vehicle 35, and displayed on screen 14a. In addition, the message ("Instruction message: Return when finished") sent via e-mail is displayed in the message portion 107 of the display screen of terminal 14. In accordance therewith, the operator riding in the transport vehicle 35 can perceive from display screen 14a the fact that the mobile work machine 31 is the next unit to be loaded, the current location thereof, the site, where this vehicle is to be off-loaded, and

specific job details.

【00148】 Further, an automatic transport route generation program is stored in terminal 14. With this automatic transport route generation program, processing for automatically generating the shortest transport travel route, which selects only roads wide enough to enable the vehicle 35 to pass through as the route from the current location of the vehicle 35, through the loading site 31 to the off-loading site 106. Accordingly, when this automatic transport route generation program is executed, the shortest transport travel route 104, which avoids narrow roads that are not wide enough for the vehicle 35 to pass through, and which goes from the vehicle 35 itself to mobile work machine 31 and on to off-loading site 106, is displayed on display screen 14a of terminal 14.

【00149】 Here, if it is possible to perform work according to the content of the work instructions, a click operation is performed on button 110 indicating "OK" on display screen 14a. Further, when the transport vehicle 35 arrives at the loading site 31, and the job of loading is started, a click operation is performed on button 114 indicating "Loading" on display screen 14a. Further, when the transport vehicle 35 arrives at the off-loading site 106, and the job of off-loading is started, a click operation is performed on button 115 indicating "Off-loading" on display screen 14a. Further, when loading and transport (off-loading) work has been completed by the transport vehicle 35, a click operation is performed on button 112 indicating "Finished" on display screen 14a. Further, when work according to the content of the work instructions cannot be undertaken for some reason, a click operation is performed on button 111 indicating "Suspended" on display screen 14a. The content of input operations resulting from these click operations on terminal 14 is sent to the management-side terminal 11 from terminal 14 via e-mail. By receiving this e-mail at terminal 11, it is possible to comprehend the state of work progress of the transport vehicle 35. Furthermore, in addition to touch operations, such as click operations, key operations, and touch-panel operations, input operations can also make use of voice input operations.

【00150】 Accordingly, it is possible for an operator to perform loading and transport (off-loading) work extremely efficiently by moving the transport vehicle 35 along the transport travel route 104 and carrying out work according to display screen 14a of

terminal 14. Furthermore, transporting other mobile work machine 31-33 on the return route of the off-loaded transport vehicle 35 (unloaded state) can increase efficiency even more.

【00151】 Furthermore, an embodiment for sending work instructions data to a terminal mounted in a hydraulic excavator or other such mobile work machine 31 from the management-side terminal 11, and causing excavation work to be performed efficiently, is also possible.

【00152】 For example, by sending data, which indicates the excavation quantity target for that day, the work completion schedule, and the current location of a dump truck for loading, to the terminal of the mobile work machine 31, it is possible to display these data on the display screen of the terminal, and to enable the operator to operate the work machinery, and efficiently perform a series of jobs for excavating dirt and loading it into the dump truck according to the display screen.

【00153】 Now, in this embodiment, data is sent and received by utilizing an Internet 2 e-mail service. In this case, the server terminal 21, as the mail server, regularly checks whether or not e-mail is inside a mailbox. Thus, a constant delay occurs from the time e-mail is sent from a terminal (for example, terminal 11) until it is actually received by a mobile unit (for example, mobile work machine 31) of the e-mail address destination.

【00154】 In this embodiment, the sending and receiving of data is performed via satellite radio communications by the communication status satellite 9. In satellite radio communications, when the communication status environment between the sending and receiving equipment is not good, such as when the maximum angle of elevation of the satellite is small, and an unobstructed view of a mobile unit is not achievable, a communication status channel 5 cannot be secured, thus requiring that processing, which attempts to establish communications, be carried out many times. Thus, a communication status environment-caused delay occurs from the time data is sent from the satellite 9 until it is actually received by a mobile unit (for example, mobile work machine 31).

【00155】 In this manner, in a communication device of this embodiment, a time difference of, for example, several minutes occurs from the time e-mail is sent by a request-origination terminal until it is received by a request-destination mobile unit. In a

communication device with such low real-time capabilities, there is the danger of the unknown communication status causing an operator of a request-origination terminal to become apprehensive, thus affecting work efficiency. Further, because the communication status is unclear, there is the danger of re-sending duplicate e-mails, thus affecting communication status costs.

【00156】 Accordingly, it is desirable to display the communication status with the respective mobile units on the display screens of terminals so as to avoid lower work efficiency and higher communication status costs due to unclear communication status.

【00157】 Furthermore, in this embodiment, requests for mobile unit information are sent out from a plurality of terminals to a single mobile unit. Consequently, it is not possible to make a judgment using a single terminal alone as to how recent the mobile unit information currently available is (when the request for mobile unit information was made).

Accordingly, it is desirable to display on the display screen of terminals the elapsed time since the last request was made to a mobile unit, and to keep operators informed of mobile unit management information, such as how recent the mobile unit information currently available is.

【00158】 The embodiment described hereinbelow responds to these requirements.

【00159】 That is, as shown in Fig. 31, icons (a picture of a hydraulic excavator, a picture of a service vehicle, and a picture of a trailer, etc.) as mobile unit identifiers corresponding to a plurality of mobile units 31-35, respectively, are displayed on a terminal 11. And then, when e-mail requesting mobile unit information is sent from a request-origination terminal 11 to a request-destination mobile work machine 31, the display mode of the icon of this mobile work machine 31 changes to the modes shown in Fig. 16 (a) according to the communication status.

【00160】 That is, as shown in Fig. 16 (a), the color of the icon of this mobile work machine 31 changes to "blue," "yellow," "green" and "red" according to changes in the communication status between the terminal 11 and the mobile work machine 31, that is, the communication status procedures "No Request," "Request in Progress," "Reply" and "No Reply."

【00161】 This will be explained by referring to the flowchart shown in Fig. 15.

【00162】 Fig. 15 shows the procedures of processing for transitioning a display in accordance with communication status procedures. This processing is performed by the server terminal 21, and the results of this processing are displayed on a display screen of the terminal 11.

【00163】 First, in the initial state, the icon of a mobile work machine 31 is displayed in the "blue" color corresponding to "No Request" (Step 201).

【00164】 At this point, when e-mail requesting mobile unit information is sent from the request-origination terminal 11 to the request-destination mobile work machine 31, and this e-mail is stored in the mailbox of the mobile work machine 31 (YES decision in Step 202), the icon of the mobile work machine 31 transitions to the "yellow" color display corresponding to "Request in Progress" (Step 203).

【00165】 Here, when e-mail returned from the request-destination mobile work machine 31 is stored in a mailbox (YES decision in Step 204), the icon of the mobile work machine 31 transitions to the "green" color display corresponding to "Reply" (Step 207). When one day has elapsed from the transition to the "Reply" state (YES decision in Step 208), the icon of the mobile work machine 31 returns to the "blue" color display corresponding to "No Request" (Step 201). In this case, when the returned mobile unit information is sent to and displayed on a display-destination terminal (for example, terminal 12), it may be constituted such that the process moves from Step 207 to Step 201 to return to the "blue" color display corresponding to "No Request."

【00166】 By contrast, when e-mail, which should have been returned from the request-destination mobile work machine 31 is not stored in a mailbox (NO decision in Step 204, YES decision in Step 205), a determination is made that it will be difficult to ensure a radio communication status channel 5, and the icon of the mobile work machine 31 transitions to the "red" color display corresponding to "No Reply" (Step 206).

【00167】 Furthermore, in the above explanation, it is supposed that a request for mobile unit information is made from terminal 11 to mobile work machine 31, but the icon of the request-destination mobile unit changes in accordance with the communication status

of the request-origination terminal in the same way even when a request for mobile unit information is made from respective terminals 11, 12, and so forth to respective mobile units 31, 32, 33, 34, 35.

【00168】 As described hereinabove, according to this embodiment, even when using communication means with low real-time capabilities, the display mode changes in accordance with the communication status, and the "degree of communication status delay" can be perceived on the display screen of terminal 11. Also, making requests that duplicate those of other terminals is eliminated. Thus, reduced work efficiency and increased communication status costs brought on by unknown communication status can be avoided.

【00169】 Next, an embodiment, which enables operators to be kept informed of mobile unit management information, such as how recent the mobile unit information currently available is, by displaying the elapsed time from the last request made to a mobile unit on the display screen of a terminal 11, will be explained.

【00170】 That is, as shown in Fig. 18, in accordance with the communication status between respective terminals 11, 12, and so forth and mobile work machine 31, in other words, the elapsed time from the last request from respective terminals 11, 12, and so forth to mobile work machine 31 changing from "No Request in Less Than One Day," to "No Request in Past One to Three Days," "No Request in Past Three Days to One Week" and "No Request in Over One Week," the color of the icon of this mobile work machine 31 changes from "blue" (No Request #0), "yellow" (No Request #1), "pink" (No Request #2) and "red" (No Request #3).

【00171】 As shown in Fig. 18, when e-mail requesting mobile unit information is sent from terminals 11, 12, and so forth to the request-destination mobile work machine 31, and this e-mail is stored in the mailbox of mobile work machine 31 (Yes decision in Step 301), a timer is reset (Step 305), and the icon of the mobile work machine 31 transitions to the "blue" color display corresponding to "No Request #0" (Step 306).

【00172】 Then, when the elapsed time following the resetting of the timer is less than one day (NO decision in Step 302), the icon of the mobile work machine 31 retains the "blue" color display corresponding to "No Request #0" (Step 306).

【00173】 Further, when the elapsed time following the resetting of the timer is longer than one day but less than three days (YES decision in Step 302, NO decision in Step 303), the icon of the mobile work machine 31 transitions to the "yellow" color display corresponding to "No Request #1" (Step 307).

【00174】 Further, when the elapsed time following the resetting of the timer is longer than three days but less than one week (YES decision in Step 303, NO decision in Step 304), the icon of the mobile work machine 31 transitions to the "pink" color display corresponding to "No Request #2" (Step 308).

【00175】 Further, when the elapsed time following the resetting of the timer is longer than one week (YES decision in Step 304), the icon of the mobile work machine 31 retains the "red" color display corresponding to "No Request #3" (Step 309).

【00176】 When e-mail requesting mobile unit information is sent from terminals 11, 12, and so forth to request-destination mobile work machine 31 while the timer is clocking time, and this e-mail is stored in the mailbox of mobile work machine 31 (Yes decision in Step 301), the timer is reset (Step 305), and the icon of a mobile work machine 31 transitions to the "blue" color display corresponding to "No Request #0" (Step 306).

【00177】 Furthermore, in the above explanation, it is supposed that the elapsed time from a final request to mobile work machine 31 is displayed on terminal 11, but this elapsed time is similarly displayed for other mobile units 32-35 as well. Further, the elapsed time from a final request to the respective mobile work machine 31, 32, 33, 34, 35 is also displayed on other terminals, such as terminal 12 and so forth.

【00178】 As described hereinabove, according to this embodiment, the state of elapsed time from the last request to the respective mobile units 31-35 can be perceived on the display screen of a terminal, and management-related information, such as how recent the mobile unit information currently available for mobile units 31-35 is, can be learned.

【00179】 Many variations are possible for the above embodiment. Hereinbelow, explanations will be given with regard to Fig. 16 (b)-(d), Fig. 17, Fig. 19 and Fig. 20.

【00180】 Next, an embodiment, which enables the display of the elapsed time since the last incoming e-mail indicating mobile unit information from a mobile unit on a

display screen of terminal 11, and which enables an operator to be kept informed of mobile unit management information, such as how recent the mobile unit information currently available is, will be explained. Here, "Incoming Message" comprises both a case in which e-mail indicating mobile unit information from a mobile unit is returned, and, as will be explained below, a case in which e-mail indicating mobile unit information from a mobile unit is automatically transmitted without a request from the terminal side.

【00181】 That is, as shown in Fig. 19, in accordance with the communication status with the mobile work machine 31, in other words, the elapsed time from the last incoming message (reply, automatic transmission) from the mobile work machine 31 to the server terminal 21 changing from "No Incoming Message in Less Than One Day," to "No Incoming Message in Past One to Three Days," "No Incoming Message in Past Three Days to One Week" and "No Incoming Message in Over One Week," the color of the icon of this mobile work machine 31 changes from "blue" (No Incoming Message #0), "yellow" (No Incoming Message #1), "pink" (No Incoming Message #2) and "red" (No Incoming Message #3).

【00182】 As shown in Fig. 19, when a reply from the mobile work machine 31 or e-mail automatically transmitted by the mobile work machine 31 is stored in the mailbox of the server terminal 21 (YES decision in Step 401), a timer is reset (Step 405), and the icon of the mobile work machine 31 transitions to the "blue" color display corresponding to "No Incoming Message #0" (Step 406).

【00183】 Then, when less than one day has elapsed from the time the timer was reset (NO decision in Step 402), the icon of the mobile work machine 31 retains the "blue" color display corresponding to "No Incoming Message #0" (Step 406).

【00184】 Further, when more than one day but less than three days has elapsed from the time the timer was reset (YES decision in Step 402, NO decision in Step 403), the icon of the mobile work machine 31 transitions to the "yellow" color display corresponding to "No Incoming Message #1" (Step 407).

【00185】 Further, when more than three days but less than one week has elapsed from the time the timer was reset (YES decision in Step 403, NO decision in Step 404), the icon of the mobile work machine 31 transitions to the "pink" color display corresponding to

"No Incoming Message #2" (Step 408).

【00186】 Further, when more than one week has elapsed from the time the timer was reset (YES decision in Step 404), the icon of the mobile work machine 31 transitions to the "red" color display corresponding to "No Incoming Message #3" (Step 409).

【00187】 When a reply from the mobile work machine 31 or e-mail automatically transmitted by the mobile work machine 31 is stored in the mailbox of the server terminal 21 while the timer is clocking time (YES decision in Step 401), the timer is reset (Step 405), and the icon of the mobile work machine 31 transitions to the "blue" color display corresponding to "No Incoming Message #0" (Step 406).

【00188】 Furthermore, in the above explanation, it is supposed that the elapsed time from a final incoming message from mobile work machine 31 is displayed, but this elapsed time is similarly displayed for other mobile units 32-35 as well. Further, the elapsed time from the last incoming message from the respective mobile work machine 31, 32, 33, 34, 35 is also displayed on other terminals, such as terminal 12 and so forth.

【00189】 As described hereinabove, according to this embodiment, the state of elapsed time from a last incoming message from the respective mobile units 31-35 can be perceived on the display screen of a terminal, and management-related information, such as how recent the mobile unit information currently available for mobile units 31-35 is, can be learned. Further, when a mobile unit (for example, mobile unit 31) is automatically transmitting at regular periods, from the content of the display of elapsed time from the last incoming message from mobile unit 31, it is possible to discern at the terminal side whether or not a communication status malfunction of some sort occurred when mobile unit 31 made an automatic transmission.

【00190】 Next, an embodiment, which enables the display of the elapsed time from the sending out of a request to a mobile unit until the receiving of a reply, and which enables a determination via a display screen of a terminal 11 as to whether or not communications are being carried out normally, will be explained by referring to Fig. 20.

【00191】 That is, as shown in Fig. 20, in accordance with a change in time during which a no-reply state continues from the last request made from a terminal 11 to a mobile

work machine 31, in other words, changes from "No Reply in Less Than One Minute," to "No Reply in Past One to Three Minutes," "No Reply in Past Three to Ten Minutes" and "No Reply in Over Ten Minutes," the color of the icon of this mobile work machine 31 changes from "green" (No Reply #0), "yellow" (No Reply #1), "pink" (No Reply #2) and "red" (No Reply #3). Further, in a state, wherein there is no request (state in which there was a response) to the mobile work machine 31 from the respective terminals 11, 12 and so forth, "blue" ("No Request") is displayed.

【00192】 As shown in Fig. 20, when e-mail requesting mobile unit information is sent to request-destination mobile work machine 31 from request-origination terminal 11, and e-mail returning from request-destination mobile work machine 31 as a reply thereto is stored in a mailbox (YES decision is Step 501), the icon of the mobile work machine 31 transitions to the "blue" color corresponding to "No Request" (Step 506).

【00193】 Then, in a state, in which a reply e-mail from request-destination mobile work machine 31 is not stored in a mailbox (NO decision in Step 501), the process moves to the next Step 502.

【00194】 In Step 502, a determination is made as to whether or not e-mail requesting mobile unit information was sent from request-origination terminal 11 to request-destination mobile work machine 31 and stored in the mailbox of mobile work machine 31, in other words, whether or not there was a request (Step 502).

【00195】 When there was a request (YES decision in Step 502), a timer is reset, and when the elapsed time following the timer being reset is less than one minute (NO decision in Step 503), the icon of the mobile work machine 31 transitions to the "green" color display corresponding to "No Reply #0" (Step 507).

【00196】 Further, when the elapsed time following the timer being reset is more than one minute but less than three minutes (YES decision in Step 503, NO decision in Step 504), the icon of the mobile work machine 31 transitions to the "yellow" color display corresponding to "No Reply #1" (Step 508).

【00197】 Further, when the elapsed time following the timer being reset is more than three minutes but less than ten minutes (YES decision in Step 504, NO decision in Step

505), the icon of the mobile work machine 31 transitions to the "pink" color display corresponding to "No Reply #2" (Step 509).

【00198】 Further, when the elapsed time following the timer being reset is more than ten minutes (YES decision in Step 505), the icon of the mobile work machine 31 transitions to the "red" color display corresponding to "No Reply #3" (Step 510).

【00199】 When e-mail returned from request-destination mobile work machine 31 is stored in a mailbox while the timer is clocking time (YES decision in Step 501), the icon of the mobile work machine 31 transitions to the "blue" color corresponding to "No Request" (Step 506).

【00200】 Furthermore, in the above explanation, it is supposed that the elapsed time until a reply is received following a request to mobile work machine 31 is displayed on terminal 11, but this elapsed time is similarly displayed for other mobile unit 32-35 as well. Further, the elapsed time from a request to the respective mobile work machine 31, 32, 33, 34, 35 is also displayed on other terminals, such as terminal 12 and so forth.

【00201】 As described hereinabove, according to this embodiment, since the elapsed time following the sending of a request to a mobile unit until a reply is received is displayed, it can readily be determined from a display screen on a terminal whether or not communications are being performed normally.

【00202】 Furthermore, in the above explanation, in accordance with the communication status between a terminal 11 and a mobile work machine 31, the color of the entire icon of this mobile work machine 31 is changed and displayed as shown in Fig. 16 (a), but the icon colors can be changed to color combinations, color arrangements, or shaded patterns. Further, a component other than color can be changed.

【00203】 For example, in accordance with the communication status between a terminal 11 and a mobile work machine 31, the shape of the icon of this mobile work machine 31 can be changed and displayed as shown in Fig. 16 (b). For example, if it is an icon of a hydraulic excavator, the position or the rounded portion of the work machinery can be changed.

【00204】 Further, in accordance with the communication status between a

terminal 11 and a mobile work machine 31, the size of the icon of this mobile work machine 31 can be changed and displayed as shown in Fig. 16 (c). For example, in the case of "Request in Progress" shown in Fig. 16 (c), the size of the hydraulic excavator icon intermittently changes from large to medium and from medium to large.

【00205】 Further, in accordance with the communication status between a terminal 11 and a mobile work machine 31, the movement of the icon of this mobile work machine 31 can be changed and displayed as shown in Fig. 16 (d). For example, in the case of "No Request" shown in Fig. 16 (c), the hydraulic excavator icon is still, in the case of "Request in Progress," the hydraulic excavator icon is rotating, in the case of "Reply," the hydraulic excavator icon moves linearly, and in the case of "No Reply," the hydraulic excavator icon jumps.

【00206】 Further, in accordance with the communication status between a terminal 11 and a mobile work machine 31, the icon of this mobile work machine 31 can be changed and displayed as a flashing pattern. For example, changing the flash cycle is being considered.

【00207】 Further, besides changing the picture of mobile work machine 31, this embodiment can be constituted such that characters or other such identification symbols identifying a mobile work machine 31 change. For example, changing the color or flashing the characters indicating the vehicle number or nickname of a mobile work machine 31 is being considered.

【00208】 By so doing, as a result of the processing shown in Fig. 15, for example, the icons of a plurality of mobile work machine 31, 32, 33, 36, 37, 38 are displayed correspondent to mobile unit information ("vehicle number," "location," "service meter") in a display screen of a terminal 11 as shown in Fig. 17 (a). In this case, as shown in this same Fig. 17 (a), the icons of the respective mobile work machine 31, 32, 33, 36, 37, 38 can be displayed on a screen in a preset order.

【00209】 Further, as shown in Fig. 17 (b), the icons of the respective mobile work machine 31, 32, 33, 36, 37, 38 can also be rearranged in accordance with the communication status, displaying the icons of mobile work machine 31, 32 corresponding to "Request in Progress" in the top positions, and displaying the icons of mobile work machine

33, 36, 37 corresponding to "No Request" in the bottom positions.

【00210】 Further, as shown in Fig. 17 (c), out of the icons of the respective mobile work machine 31, 32, 33, 36, 37, 38, only the icons of mobile work machine 31, 32 corresponding to "Request in Progress" can be extracted and displayed.

【00211】 As described hereinabove, according to this embodiment, since the content of a terminal display changes in accordance with changes in communication status, it is possible to prevent decreases in work efficiency resulting from unknown communication status, and it is also possible to prevent increases in communication status costs. Further, it is possible to obtain management information (whether or not maintenance and inspections have been performed recently), such as how recent the mobile unit information of the respective mobile unit is, from a display screen.

【00212】 This embodiment, wherein the content of a terminal display changes in accordance with changes in communication status, is not limited to the communication device shown in Fig. 1, and can be applied to an arbitrary communication device. If a communication device comprises at a minimum two communication status stations, and performs communications between two communication status stations, then this embodiment is applicable.

【00213】 Next, an embodiment, which enables wasteful communication status-related power consumption to be held in check by the mobile unit 31-35 side intermittently turning OFF power on its own, will be explained.

【00214】 For mobile work machine such as construction machine, the time period during which the engine is not running (that is, the time period during which it is operating with the power OFF) is long.

【00215】 In Fig. 21, for instance, if a communication terminal 56 is constantly electrically connected to a battery 63 (rated voltage 24V) even while the engine is OFF, since the engine is not running, the battery 63 is not charged by an alternator. Thus, battery 63 discharge will occur rapidly. On the other hand, for instance, if the electrical connection between the battery 63 and the communication terminal 56 is constantly OFF while the engine is OFF, communications with a plurality of terminals 11, 12 and so forth,

will become impossible. Thus, when there is a request for mobile unit information from a the terminal 11, 12 and so forth side when the engine is OFF, it is not possible to reply to this request.

【00216】 Accordingly, the embodiment described hereinbelow is constituted so as to make it possible to communicate with a plurality of terminals 11, 12 and so forth while an engine is OFF, to enable a reply to be given to a request from a terminal 11, 12 and so forth, and, in addition, to enable wasteful power consumption to be held in check even for construction machine and other such mobile units 31-35 for which engine non-running time is long.

Fig. 21 shows the constitution of this embodiment.

【00217】 As explained by Fig. 2, a communication terminal 56 is provided onboard a mobile work machine 31. And the power terminal of this communication terminal 56 is electrically connected to a battery 63. A main power circuit is disposed inside the communication terminal 56, and power is consumed by the power of the battery 63 being supplied to this main power circuit. Either an internal program (software timer) is stored inside the communication terminal 56, or an internal power circuit (hardware timer) is incorporated into the communication terminal 56, and in accordance therewith, the communication terminal 56 is operated such that main power circuit drive is intermittently turned ON and OFF, enabling power savings to be performed periodically by the main power circuit.

【00218】 The level of an engine key switch signal S1 inputted to a sleep control terminal of the communication terminal 56 is monitored by software, and when it is an ON signal, and the main power circuit of the communication terminal 56 is OFF, processing for forcibly driving the main power circuit is performed. Further, it may be constituted such that the main power circuit is driven by hardware.

【00219】 That is, when an OFF signal (logical "0" level signal) of an engine key switch signal S1 is inputted to the sleep control terminal of the communication terminal 56, the electrical connection between the main power circuit on the inside of the communication terminal 56 and the battery 63 is turned ON and OFF at a predetermined duty ratio, the drive of the main power circuit is turned ON and OFF, activation of the communication terminal

56 is turned ON and OFF, and communication status processing is performed on a fixed cycle (the communication terminal 56 sleep function is ON).

【00220】 In accordance with an ON signal (logical "1" level signal) of an engine key switch signal S1 being inputted to the sleep control terminal of the communication terminal 56, the main power circuit on the inside of the communication terminal 56 and the battery 63 are electrically connected, the main power circuit is driven, the communication terminal 56 is started up, and communication status processing is performed (the communication terminal 56 sleep function is OFF (forcibly terminated). Accordingly, it becomes a state, in which the communication terminal 56 is constantly operating while the engine is ON.

【00221】 Meanwhile, the power terminal of the communication status controller 54 is electrically connected to the battery 63 via the engine key switch 64. In accordance with the engine key switch 64 being turned OFF, the electrical connection between the communication status controller 54 and the battery 63 is cut off, and, in addition, the operation of the engine of the mobile work machine 31 is stopped.

In accordance with the engine switch key 64 being turned ON, an ON signal (logical "1" level signal) of an engine key switch signal S1 is outputted to the sleep control terminal of the communication terminal 56 from the communication status controller 54.

【00222】 Next, the processing performed by the communication terminal 56 will be explained utilizing the timing charts shown in Fig. 7.

【00223】 Fig. 7 (a) shows an operating signal S1 of the engine key switch 64, and Fig. 7 (b) shows the communication status between the communication terminal 56 and the communication status satellite 9. Communications in progress is indicated by the logical "1" level. Fig. 7 (c) shows the activation status of the communication terminal 56. The logical "1" level corresponds to the activation state (power-saving operation OFF), and the logical "0" level corresponds to the activation OFF (sleep) state (power-saving operation ON). The activation of the communication terminal 56 is intermittently turned ON and OFF at duty ratio D (= τ/T x 100%). At the timing at which a power-saving operation is OFF and the communication terminal 56 is started up, signals indicating mobile unit information, such as current location, service meter values, remaining fuel, battery voltage,

and vehicle error codes, are sent to the communication status satellite 9 from the communication terminal 56 as needed.

【00224】 As shown in Fig. 7, when the engine key switch S1 is maintained in the ON state, the communication terminal 56 is constantly activated.

【00225】 When the engine key switch S1 is switched from ON to OFF, the activation of the communication terminal 56 is intermittently turned ON and OFF according to duty ratio D (= τ/T x 100%) as indicated by arrow a (sleep function is ON).

【00226】 That is, Fig. 8 (b) is a timing chart showing the ON, OFF of a power-saving operation corresponding to Fig. 7 (c), and Fig. 8 (c) shows the transmission state of a call request signal to the communication terminal 56 from the communication status satellite 9. The logical "1" level indicates a transmission in progress.

【00227】 As shown in these figures, a time τ when the communication terminal 56 is inevitably active, in other words, a time when it is possible to send to and receive from the communication status satellite 9, exists within a fixed time (activation period) T (Refer to the slashes in Fig. 8 (c).). The expected value of communication reply time is T/2 (the average is T/2). Further, power consumption can be held down to τ/T. To enable sending and receiving between the communication terminal 56, which is performing a power-saving operation during the activation period T, and the communication status satellite 9, it is necessary for the communication status satellite 9 to continuously send a signal to the communication terminal 56 for a period of time longer than T (Refer to Fig. 8 (b), (c)). The activation period T is determined in accordance with the criticality of the communications, and the safety factor relative to the duration of the signal sent out from the communication status satellite 9.

【00228】 Further, for the active time τ, it is necessary to ensure a time period longer than that required for sending and receiving procedures. However, the shorter the active time τ, the greater the power-saving effect.

【00229】 By so doing, by regularly starting up the communication terminal 56 for a period constituting T, it is possible to ensure an expected value for communication status reply time, and, in addition, it is possible to hold down power consumption.

【00230】 However, as shown in Fig. 7, even when the engine key switch signal S1 is switched from ON to OFF, if communications between the communication terminal 56 and the communication status satellite 9 are in progress as indicated by arrow c, the sleep function turns ON from that point in time when communications end as indicated by arrow d.

【00231】 When the engine key switch signal S1 is switched from OFF to ON, the sleep function is forcibly terminated as indicated by arrow b.

【00232】 As described hereinabove, according to this embodiment, because the sleep function is forcibly terminated when the engine is operated, and the communication terminal 56 is constantly active during engine operation, mobile unit information, such as a sudden vehicle abnormality that occurs during engine operation, can be transmitted, and safety can be ensured. Further, if communications are in progress, because the communication terminal 56 remains active as-is until the end of communications even when engine operation is stopped, communications can be performed with certainty.

【00233】 The above-mentioned duty ratio D can be changed to conform to the terminal voltage of the battery 63.

【00234】 The voltage of the battery 63 is inputted to a battery voltage input circuit, and duty ratio D changes in accordance with the characteristics shown in Fig. 8 (a).

【00235】 That is, as the voltage of the battery 63 becomes lower, the duty ratio D becomes smaller, and the activation period T becomes longer, holding in check further drops in battery 63 voltage.

【00236】 Further, due to the same characteristics as the characteristics shown in Fig. 8 (a), further reductions of the battery 63 voltage can be checked by the fact that, as engine operation time becomes shorter, the duty ratio D becomes smaller, and the activation period becomes longer. Engine operation time is determined from the incremental value of the service meter. The continuous operation time of the engine up until prior to the sleep function being turned ON (prior to the start of intermittent power-saving operations) is determined from the incremental value of the service meter, and the duty ratio D changes in conformance to this continuous operation time. In this case, the provision of a battery

voltage input circuit becomes unnecessary.

【00237】 According to the above-described constitution shown in Fig. 21, because a power-saving operation is carried out via processing inside the communication terminal 56, it is advantageous in that abnormalities in other equipment or wiring have no effect. The constitution shown in Fig. 22 can be used instead of the constitution of Fig. 21. That is, a power-saving operation control function at engine key switch 64 ON can be provided in equipment other than the communication terminal 56, for example, in the communication status controller 54, and the ON, OFF of the electrical connection between the communication terminal 56 and the battery 63 can by intermittently controlled by this communication status controller 54.

【00238】 That is, as shown in Fig. 22, the power terminal of the communication terminal 56 is electrically connected to the battery 63 via a power switch 65. The electrical connection between the communication terminal 56 and the battery 63 is cut off in accordance with the power switch being turned OFF.

【00239】 Meanwhile, the power terminal of the communication status controller 54 is electrically connected to the battery 63. Further, the operating signal S1 of engine key switch 64 is inputted into the communication controller 54. Further, a signal S3 indicating the communication status is inputted from the communication terminal 56 to the communication controller 54. When the communication terminal 56 is in the process of communicating with the communication satellite 9, the communication status signal S3 becomes a logical "1" level.

【00240】 Either a software timer is stored, or a hardware timer is incorporated inside the communication controller 54, and a power switch drive signal S2 is outputted to the power switch 65.

【00241】 The communication controller 54 executes the same processing as was explained using Fig. 7.

【00242】 Fig. 7 (a) shows the operating signal S1 of the engine key switch 64, which is inputted to the communication controller 54, Fig. 7 (b) shows the communication status signal S3, which is inputted from the communication terminal 56 to the

communication controller 54, and Fig. 7 (c) shows the power switch drive signal S2, which is outputted from the communication controller 54 to the power switch 65.

【00243】 Accordingly, similar to the constitution shown in Fig. 21, when the engine stops running (signal S1 is OFF), the activation of the communication terminal 56 is controlled ON, OFF at a predetermined duty ratio D (signal S2 turns ON and OFF). Further, when the engine is running (signal S1 is ON), the above-described sleep function is forcibly terminated, and the communication terminal 56 is constantly in an active state during engine operation (signal S2 is ON). Further, even when engine operation is halted, if communications are in progress (S3 is ON), the communication terminal 56 remains in the active state until communications end (S2 is ON).

【00244】 Furthermore, duty ratio D can similarly be changed in conformance to the battery 63 terminal voltage or engine operation time.

【00245】 Many variations of the above-described embodiment are possible. Hereinbelow, explanations will be given with regard to Fig. 13, Fig. 23, Fig. 24 and Fig. 25.

【00246】 The above-mentioned duty ratio D can be changed in accordance with the location information of a mobile work machine 31.

【00247】 Fig. 23 shows an embodiment for changing the duty ratio D for mobile work machine 31 in accordance with a relative travel distance in relation to a set range.

【00248】 Fig. 23 (a) shows a situation in which the activation period T is shortened and the duty ratio D is increased in conformance to mobile work machine 31 departing from a set range 117 on a map.

【00249】 That is, most ordinary automobiles move under their own power. By contrast, construction machine and other mobile work machine 31 seldom travel long distances under their own power, and in most cases, shut off their own engines and are loaded on trailers and moved. And such cases are not limited to those in which the mobile work machine 31 is loaded and transported on a trailer 35, which is managed on the terminal 11 side, but rather, there are also cases in which mobile work machine 31 is loaded onto a trailer that is not managed, and is illegally transported overseas. Further, there is also the danger that mobile work machine 31 will be inadvertently transported by a trailer

35, and conveyed without permission to an administratively unapproved work area.

【00250】 Therefore, when the operation of the engine of mobile work machine 31 is stopped, there is a need to manage and monitor the travel locus of the mobile work machine 31 by displaying the movement and location of this mobile work machine 31 on a terminal 11 in accordance with a request from the terminal 11, while holding down power consumption in line with communications.

【00251】 Accordingly, a predetermined range 117, within which mobile work machine 31 is normally expected to be, is set on a map of a display screen of a terminal 11. For example, this set range 117 is a management area for which a manager on the terminal 11 side is responsible, or an administratively approved work area.

【00252】 The activation of the communication terminal 56 of mobile work machine 31 is intermittently turned ON and OFF at a predetermined duty ratio D (= τ/T x 100%) as shown in the above-described Fig. 7. And then, as shown in Fig. 7 (c), a power-saving operation is turned OFF (a power switch drive signal S2 is turned ON), and at the timing during which the communication terminal 56 is active, a signal indicating current location (in addition, mobile unit information, such as service meter values, remaining fuel, battery voltage, and vehicle error codes, can also be included) is sent to the communication satellite 9 from the communication terminal 56 in accordance with a request from a terminal 11. In accordance therewith, the sequential travel locations of the mobile work machine 31 are displayed on the terminal 11, which is the display-destination terminal.

【00253】 The location of the mobile work machine 31 is detected by the GPS sensor 57 as shown in Fig. 2. In this case, if the power consumption of the GPS measurement devices (GPS antenna 59, GPS sensor 57, communication controller 54) is insufficient, these GPS measurement devices can be electrically connected directly to the battery 63 and operated at all times. Further, when the power consumption of these GPS measurement devices is high, similar to the communication terminal 56, the above-described sleep function can be turned ON, a power-saving operation can be turned ON and OFF, and the GPS measurement devices can be operated and measure a location only when a power-savings operation is ON (when the communication terminal 56 is active).

【00254】 The location detected by the GPS sensor 57 for the mobile work machine 31, and the boundary location of the set range 117 are compared, and processing for changing the activation period T is executed in accordance with the results of this comparison.

【00255】 Fig. 23 (d) shows a situation in which the activation period T is changed in accordance with a relative location (passage of time) in relation to the set range 117 of the mobile work machine 31.

【00256】 As shown in Fig. 23 (a), when the mobile work machine 31 exists in locations A, B within the normal set range 117, the activation period T constitutes the maximum period T1.

【00257】 However, when the mobile work machine 31 reaches the boundary location C of the normal set range 117, a determination is made that the mobile work machine 31 has departed the normal range, and that an abnormal situation has occurred (traveled outside authorized area), and to obtain detailed information of its travel locus, the activation period T becomes a period T2, which is shorter than the maximum period T1 (Refer to Fig. 23 (d)).

【00258】 When the mobile work machine 31 reaches location D, which is further separated by a predetermined distance L0 from the boundary location of the normal set range 117, to obtain even more detailed information on its travel locus, the activation period T becomes a period T3, which is even shorter than the period T2 (Refer to Fig. 23 (d)). Thereafter, as the separation distance from the normal set range 117 increases, the activation period T can be set to T4 (<T3), and so forth, becoming sequentially shorter until it ultimately reaches period 0 (duty ratio D = 1).

【00259】 Furthermore, as shown in the graph of Fig. 23 (c), as the separation distance relative to the boundary location of the normal set range 117 becomes greater, the activation period T can be made consecutively shorter.

【00260】 In line with the activation period T of the communication terminal 56 becoming shorter, the response to a request from a terminal 11 becomes faster. Furthermore, as will be explained hereinbelow, when the mobile work machine 31 is

transmitting automatically, the transmission interval of mobile unit information, such as location information, becomes shorter.

【00261】 Accordingly, in accordance with the mobile work machine 31 separating from the normal set range 117, a more detailed travel locus (a travel locus, the time interval between each displayed travel location of which is short) is displayed on a display screen of the terminal 11, which is the display-destination terminal. Thus, it is possible to deal quickly and accurately with an abnormal situation, such as mobile work machine 31 traveling outside of an authorized area. Moreover, because the ON, OFF duty ratio D of the activation of the communication terminal 56 increases in accordance with the mobile work machine 31 moving away from the normal set range 117, it is possible to hold down power consumption in line with communications, while at the same time accurately monitoring the abnormal situation.

【00262】 Fig. 23 (b) shows a situation in which the activation period T becomes shorter and the duty ratio D becomes larger in conformance to mobile work machine 31 entering a set range 118 on a map.

【00263】 The same as in Fig. 23 (a), a predetermined range 118, within which mobile work machine 31 would not normally be brought, is set on a map of a display screen of a terminal 11. This set range 118 is an abnormal area, for example, an area in which it is against the law to work, such as a foreign harbor, a hazardous work area, a nature conservation area, or the like.

【00264】 Similar to the explanation given for Fig. 23 (a), the location of the mobile work machine 31 detected by the GPS sensor 57, and the boundary location of set range 118 are compared, and processing for changing the activation period T is executed in accordance with the results of this comparison.

【00265】 Fig. 23 (d) shows a situation in which the activation period T is changed in accordance with a relative location (passage of time) in relation to the set range 118 of the mobile work machine 31.

【00266】 As shown in Fig. 23 (b), when the mobile work machine 31 exists in locations A, B outside of the abnormal set range 118, the activation period T constitutes the

maximum period T1.

【00267】 However, when the mobile work machine 31 reaches the boundary location C of the abnormal set range 118, a determination is made that an abnormal situation has occurred (entered a hazardous area), and to obtain detailed information of the mobile work machine's 31 travel locus, the activation period T becomes a period T2, which is shorter than the maximum period T1 (Refer to Fig. 23 (d)).

【00268】 When the mobile work machine 31 reaches location D, at which it has further penetrated the abnormal set range 118 by a predetermined distance L0 from the boundary location, to obtain even more detailed information on its travel locus, the activation period T becomes a period T3, which is even shorter than period T2 (Refer to Fig. 23 (d)). Thereafter, as the penetration distance into the abnormal set range 118 increases, activation period T can be set to T4 (<T3), and so forth, becoming sequentially shorter until it ultimately reaches period 0 (duty ratio D = 1).

【00269】 Furthermore, as shown in the graph of Fig. 23 (c), as the distance L relative to the boundary location of the abnormal set range 118 becomes greater, the activation period T can be made consecutively shorter.

【00270】 In accordance with the mobile work machine 31 entering into the abnormal set range 118 like this, a more detailed travel locus (a travel locus, the time interval between each displayed travel location of which is short) is displayed on a display screen of the terminal 11, which is the display-destination terminal. Thus, it is possible to deal quickly and accurately with an abnormal situation, such as a mobile work machine 31 entering a hazardous area. Moreover, because the ON, OFF duty ratio D of the activation of the communication terminal 56 increases in accordance with the penetration of the mobile work machine 31 into the abnormal set range 118, it is possible to hold down power consumption in line with communications, while at the same time accurately monitoring the abnormal situation.

【00271】 Furthermore, this embodiment is not limited to monitoring the abnormal situations hypothesized by Fig. 23 (a), (b), but rather can also be used to monitor the route to the location where mobile work machine 31 is discarded and disposed of.

【00272】 Further, the embodiment shown in Figs, 23 (a) and 23 (b) is constituted such that the activation period T is univocally determined from only the distance L to a boundary line of a set range 117, 118, but the activation period T can also be determined by also taking factors other than distance L into consideration, such as orientation, surrounding geographical information, type of mobile unit, and mobile unit utilization period.

【00273】 Further, the duty ratio D can also be changed in accordance with the extent of the change of location of mobile work machine 31 as shown in Fig. 24.

【00274】 The activation of the communication terminal 56 of mobile work machine 31 is intermittently turned ON and OFF at a predetermined duty ratio D (= τ/T x 100%) as shown in the above-described Fig. 7. And then, as shown in Fig. 7 (c), a power-saving operation is turned OFF (a power switch drive signal S2 is turned ON), and at the timing during which the communication terminal 56 is active, a signal indicating current location (in addition, mobile unit information, such as service meter values, remaining fuel, battery voltage, and vehicle error codes, can also be included) is sent to the communication satellite 9 from the communication terminal 56 in accordance with a request from a terminal 11. In accordance therewith, the sequential travel locations of the mobile work machine 31 are displayed on the terminal 11, which is the display-destination terminal.

【00275】 The location of the mobile work machine 31 is detected by the GPS sensor 57 as shown in Fig. 2. In this case, if the power consumption of the GPS measurement devices (GPS antenna 59, GPS sensor 57, communication controller 54) is insufficient, these GPS measurement devices can be electrically connected directly to the battery 63 and operated at all times. Further, when the power consumption of these GPS measurement devices is high, similar to the communication terminal 56, the above-described sleep function can be turned ON, a power-saving operation can be turned ON and OFF, and the GPS measurement devices can be operated and measure a location only when a power-savings operation is ON (when the communication terminal 56 is active).

【00276】 The current location detected for the mobile work machine 31 by the GPS sensor 57 at this activation, and the boundary location of circles 119, 120, and so forth of radius S, which have the locations detected at the last activation at their centers, are

compared, and processing for changing the activation period T is executed in accordance with the results of this comparison.

【00277】 Fig. 24 (b) shows a situation in which the activation period T changes in accordance to whether or not a mobile work machine 31 has moved outside of circles 119, 120 and so forth.

【00278】 As shown in Fig. 24 (a), first the location A of mobile work machine 31 is detected by the GPS sensor 57, and a circle 119 of a radius S(km), which has location A at the center, is set on a map. The initial activation period T is set at the maximum period T1. Thus, the communication terminal 56 is started up after the period T1. It is supposed that the location detected by the GPS sensor 57 at that time was location B of the inside of circle 119. In this case, the activation period T is left at the maximum period T1 as-is. After another period T1, the communication terminal 56 is activated, and it is supposed that the location detected by the GPS sensor 57 at that time was location C of the outside of circle 119. In this case, a circle 120 of a radius S(km), which has location C at the center, is set on the map, and, in addition, the activation period T is changed to a period T2, which is shorter than the maximum period T1.

【00279】 Thus, after the period T2, the communication terminal 56 is activated. It is supposed that the location detected by the GPS sensor 57 at that time was location D of the inside of circle 120. In this case, the activation period T is left at the period T2 as-is. After another period T2, the communication terminal 56 is activated, and it is supposed that the location detected by the GPS sensor 57 at that time was location E of the outside of circle 120. In this case, a circle 121 of a radius S(km), which has location E at the center, is set on the map, and, in addition, the activation period T is changed to a period T3, which is shorter than the period T2. Furthermore, after the period T3, the communication terminal 56 is activated, and it is supposed that the location detected by the GPS sensor 57 at that time was location F of outside of circle 121. In this case, a circle 122 of a radius S(km), which has location F at the center, is set on the map, and, in addition, the activation period T is changed to a period T4, which is shorter than the period T3. Thus, after the period T4, the communication terminal 56 is activated. It is supposed that the location detected by the GPS sensor 57 at that time was location G of the inside of circle 122. In

this case, the activation period T is returned from the period T4 to the period T3, which is longer (Refer to Fig. 24 (b)).

【00280】 Furthermore, in the embodiment shown in Fig. 24 (a), areas of circles 119, 120 and so forth of radius S are set, but instead of this, the embodiment can be constituted to set square areas having a side S.

【00281】 In the case of a square area, it is advantageous in that, when the current location detected at this activation by the GPS sensor 57, and the boundary location of the area, which has the location detected at the last activation at its center, are compared, a determination as to whether or not the mobile work machine 31 is outside the area can be made simply by subtracting the latitude and the longitude on the map without having to perform a complex operation.

【00282】 Further, an embodiment, which treats areas 119, 120 and so forth shown in Fig. 23 (a) as a shape other than a circle or square is also possible. For example, an elliptic or rectangular area, which is elongated in either of the two directions of latitude or longitude, can also be used. Alternatively, the area may take an elliptic or rectangular shape extending in the direction in which the mobile work machine 31 travels. In this case, a determination as to whether or not the mobile work machine 31 has gone outside an area can be made more rapidly and more accurately.

【00283】 Further, the size of the areas 119, 120 and so forth, more specifically, the value of the radius S(km) if the areas are circles, can be changed in accordance with the amount of movement.

【00284】 Thus, in the case of Figs. 24 (a) and 24 (b), the activation period T becomes shorter, and a more detailed travel locus (a travel locus, the time interval between each displayed travel location of which is short) is displayed on a display screen of the terminal 11, which is the display-destination terminal, equivalently in accordance with the travel velocity of mobile work machine 31 increasing. For this reason, it is possible to accurately comprehend, via the terminal 11, a condition, in which work has been completed at one work site, and the mobile work machine 31 is moving to the next work site. Thus, the work efficiency of process management and transport management is dramatically improved. Moreover, because the ON, OFF duty ratio D of the activation of the

communication terminal 56 is increased in conformance with the travel velocity of the mobile work machine 31 becoming greater, accurate monitoring during travel, and the curbing of power consumption in line with communications can be realized simultaneously.

【00285】 The embodiment shown in Figs. 24 (a) and 24 (b) is constituted such that the activation period T is changed in accordance with whether or not the mobile work machine 31 has gone beyond areas 119, 120 and so forth, which are set up sequentially, but as shown in the graph of Fig. 25, the travel velocity V of the mobile work machine 31 can be computed for each activation period T, and the activation period T can be changed in accordance with the size of the computed velocity V thereof.

In the embodiment shown in this Fig. 25, similar to the embodiment of Figs. 24 (a) and 24 (b), each time the communication terminal 56 is started up, the location of the mobile work machine 31 is detected by the GPS sensor 57.

【00286】 And then, the travel velocity V is computed using the below equation:

V = (location detected at this activation - location detected at last activation) /current activation period T

【00287】 The relationship between the travel velocity V and the activation period T is shown in the graph of Fig. 25. When the travel velocity V is slow enough, that is, less than velocity V1 (= 3km/h), the activation period T is set at the maximum period T1 (= 10 minutes). As the travel velocity V increases from V1 to the cruising velocity V2 (= 50 km/h) when transported by a trailer, the activation period T becomes shorter. And then, when the travel velocity V reaches the cruising velocity V2, the activation period T becomes 0 (duty ratio D is 1), that is, the communication terminal 56 is in a continuously active state.

【00288】 The activation period T is determined by finding the activation period T corresponding to the travel velocity V determined by the above operational expression from the graph shown in Fig. 25.

【00289】 Thus, in accordance with the travel velocity V of a mobile work machine 31 increasing, the activation period T becomes shorter, and a more detailed travel locus (a travel locus, the time interval between each displayed travel location of which is short) is displayed on a display screen of the terminal 11, which is the display-destination terminal. For this reason, it is possible to accurately comprehend on the terminal 11 side a condition,

in which work has been completed at one work site, and the mobile work machine 31 is moving to the next work site. Further, at the cruising velocity V2 of a transport vehicle (trailer) 35, because the communication terminal 56 constitutes a continuously active state, and the travel location of the mobile work machine 31 is displayed at all times, it becomes possible to constantly monitor on a display screen of a terminal 11 a situation, in which, for example, a trailer 35, which according to the rules is not permitted to travel on an expressway, is traveling carrying the mobile work machine 31. Thus, the work efficiency of process management and transport management is dramatically improved. Moreover, because the ON, OFF duty ratio D of the activation of the communication terminal 56 increases in conformance with the travel velocity of the mobile work machine 31 becoming greater, accurate monitoring during travel, and the curbing of power consumption in line with communications can be realized simultaneously.

【00290】 In the above-described embodiment, the activation of the communication terminal 56 is performed intermittently at predetermined periods T, but the activation of the communication terminal 56 can also be performed intermittently each time it becomes a specified time.

【00291】 For example, an embodiment, which activates the communication terminal 56 when it is a specified time at which communications between the communication satellite 9 and mobile work machine 31 can be carried out satisfactorily, is also possible. This specified time corresponds to the location (altitude) of the communication satellite 9.

【00292】 Fig. 13 (a) shows the physical relationship of the communication satellite 9 and the mobile work machine 31. Mountains, buildings and other obstacles 123 to communications exist in the communication satellite path (radio communication satellite channel 5) between the communication satellite 9 and the mobile work machine 31.

【00293】 When the altitude of the communication satellite 9 is high (when the maximum angle of elevation is large), there is little communication satellite interference due to obstacles 123, and the state of communications is good. Accordingly, when it becomes the time at which the altitude of the communication satellite 9 is high, the communication terminal 56 is activated, and communications with the communication satellite 9 is

performed.

【00294】 However, to activate the communication terminal 56, it is necessary to store in advance data on the flight position of the communication satellite 9 at the mobile work machine 31 side.

【00295】 The flight position data of the communication satellite 9 changes daily. Thus, if an attempt is made to store flight position data for all dates in mobile work machine 31 memory, this will give rise to insufficient memory capacity and memory occupation problems.

【00296】 Accordingly, in this embodiment, a predetermined quantity of flight position data 124 is sent via a radio communication channel 5 to the mobile work machine 31 from the communication satellite 9 as shown in Fig. 13 (a).

【00297】 A clock is provided on the inside of the communication terminal 56 of the mobile work machine 31. Consequently, by collating the received flight position data 124 against the time clocked by the clock, a determination is made as to whether or not to activate the communication terminal 56.

【00298】 Fig. 13 (b) shows the flight position data of the communication satellite 9 for a certain date.

【00299】 In this Fig. 13 (b), "AOS" indicates the time and azimuth angle at which the communication satellite 9 appears on the horizon, "MEL" indicates the time and azimuth angle when the communication satellite is at the maximum angle of elevation, and "LOS" indicates the time and azimuth angle at which the communication satellite 9 disappears over the horizon. The path of the communication satellite 9, which corresponds to an enclosed portion, is shown in Fig. 13 (c).

【00300】 In the communication terminal 56 of the mobile work machine 31, processing, which activates the communication terminal 56 at a time when a maximum angle of elevation of greater than a predetermined threshold value (for example, 45 degrees) is obtained from the flight position data 124 shown in Fig. 13 (b), in other words, at the times 4:33, 16:28 at which maximum angles of elevation 66°, 54° are obtained, is executed. That is, when it becomes the specified times 4:33, 16:28, the main power circuit of the

communication terminal 56 is driven, and a signal designating mobile unit information is sent to the communication satellite 9 via a radio communication channel 5.

【00301】 Further, as for the flight position data 124, for example, new data is sent from the communication satellite 9 to the mobile work machine 31 via the radio communication channel 5 every day at the above specified times. In accordance therewith, the content of the flight position data 124 stored in the memory of the mobile work machine 31 is updated.

【00302】 As described hereinabove, according to the embodiment shown in Fig. 13, because the communication terminal 56 is activated whenever it becomes a specified time at which communications between the communication satellite 9 and the mobile work machine 31 can be performed satisfactorily, power savings can be achieved, and, in addition, communications between the communication satellite 9 and the mobile work machine 31 can be carried out with certainty. Further, since the flight position data 124 is received from the outside via communications, insufficient memory capacity and memory occupation problems are not incurred.

【00303】 Further, in the above-described embodiment, activation of the communication terminal 56 is performed intermittently at predetermined periods T, but, for example, an embodiment, in which this activation period T is arbitrarily changed from the management-side terminal 11, is also possible. In this case, as explained hereinabove, e-mail describing change-data to the effect that the activation period T is to be changed is sent from terminal 11 to mobile work machine 31 having this mobile work machine 31 as the e-mail address. And then, the change-data described in the e-mail is read out in the communication terminal 56 of the transmission-destination mobile work machine 31, and the activation period T is changed in accordance with the content of this change-data.

【00304】 For example, when the service meter of the mobile work machine 31 goes beyond a predetermined value (when becomes obsolete), the activation period T is shortened to diligently perform status monitoring at short intervals, and when the mobile work machine 31 is rented to a certain user (when there is no need for monitoring), or when it is resting for a long time (when it is clear that operation has stopped), the activation period T is lengthened to increase the monitor interval, and to reduce wasteful power consumption

and communication channel charges. Furthermore, it is also possible to simultaneously change to the same activation period T for a plurality of mobile units, which are working and traveling as a group.

【00305】 In this manner, according to this embodiment, it is possible to change an activation period T at the terminal 11 side via a remote operation while monitoring the status of a mobile unit and the surrounding situation. Thus, it is not necessary to dispatch a worker to the respective sites of mobile units 31, 32, and so forth to perform the work of changing the activation period T, greatly reducing the workload.

【00306】 In this manner, according to this embodiment, even construction machine and other mobile units 31-35, the engines of which are not operated for long periods of time, can communicate with a plurality of terminals 11, 12 and so forth while their engines are OFF, and are capable of responding to requests from terminals 11, 12 and so forth, and, in addition, wasteful power consumption can be held in check.

【00307】 The embodiment for intermittently turning ON this communication channel power source is not limited to the communication device shown in Fig. 1, and can be applied to an arbitrary communication device. This embodiment is applicable so long as a communication device comprises at the least two communication channel stations, and communications are performed between two communication stations.

【00308】 Now, in the above-described embodiment, it is supposed that only when there is a request for mobile unit information from a request-origination terminal (for example, terminal 11) to a request-destination mobile unit (for example, mobile work machine 31) is mobile unit information displayed on a display-destination terminal (for example, terminal 12).

【00309】 The embodiment described hereinbelow is constituted such that, if a parameter on the inside of a mobile unit is a specified value, specified mobile unit information is automatically transmitted, and this specified mobile unit information is displayed on a terminal even under conditions in which there is no request from the terminal side.

【00310】 According to this embodiment, it is possible to recognize an abnormal

condition (for example, a malfunction), which occurs in a mobile unit, which cannot be constantly managed and monitored by the terminal side, and it is possible to accurately comprehend an operating state and a resting state of the mobile unit.

【00311】 Now, it is supposed that an internal parameter of mobile work machine 31, for example, the start state of the engine, is detected by a predetermined sensor from among a group of sensors 62 (for example, the sensor for detecting an alternator voltage value) as shown in Fig. 2. This sensor detection signal, as explained hereinabove, is inputted to the communication terminal 56 via the communication controller 54 by being described in a frame signal and sent out over the signal wire 52 by the electronic control controller 53. Furthermore, if the ON, OFF states of an engine can be monitored by the communication terminal 56, then a well-known technology other than this method can also be utilized.

【00312】 Fig. 26 (a) shows a signal designating the start state of an engine, which is inputted into the communication terminal 56 of the mobile work machine 31. Fig. 26 (a) shows the engine start state of each time t of the day (from 6:00AM until the 6:00AM the next day), a logical "1" level corresponds to a state in which the engine is running (started), and a logical "0" level corresponds to a state in which engine operation is stopped.

【00313】 An automatic transmission from the mobile work machine 31, for example, can be performed at the timing of each engine start as shown in Fig. 26 (b).

【00314】 That is, as shown in Fig. 26 (a), when the engine is started at timing t1, and a signal indicating the engine is started is inputted into the communication terminal 56, this signal acts as a trigger as indicated by arrow e, and specified mobile unit information, in other words, the current location of the mobile work machine 31, is incorporated in e-mail, and sent to the communication satellite 9 as e-mail. It is supposed that the e-mail address to which this e-mail is addressed is server terminal 21. When the communication terminal 56 is sleeping as a result of an above-described power-saving operation, this e-mail is sent after the engine has been started and forcibly activated.

【00315】 Consequently, if it is supposed that server terminal 21 is a management-side terminal, the sequential locations of each time the engine is started by the mobile work machine 31 are displayed on a display screen of the management-side terminal 21.

Accordingly, it is possible for a manager to grasp the history of locations of each time the engine is started by a mobile work machine 31 on the display screen without having to carry out a request input operation on his own, it is possible to perceive an abnormal situation, which occurs to the mobile work machine 31, which is incapable of being managed and monitored at all times, and it is possible to accurately comprehend an operating state and a resting state of the mobile work machine 31.

【00316】 Further, e-mail can also be sent from the mobile work machine 31 having another terminal 11, terminal 12, and so forth as the e-mail address.

【00317】 Further, an automatic transmission from the mobile work machine 31 can also be performed at the timing of the initial engine start of the day as shown in Fig. 26 (c).

【00318】 That is, as shown in Fig. 26 (a), when the engine is started at timing t1, a start signal indicating that the engine is started is inputted into the communication terminal 56. Here, a clock is provided on the inside of the communication terminal 56, and a determination is made as to whether or not this start signal is the signal initially inputted during the day (from 6:00 until 6:00 the next day). Only when the inputted start signal is determined to be the initially inputted start signal is this start signal treated as a trigger, and, as indicated by arrow f, the current location of the mobile work machine 31 is incorporated into e-mail, and sent to the communication satellite 9 as e-mail. Accordingly, a history of locations of the mobile work machine 31 is similarly displayed on a management-side terminal. According to this embodiment, since the automatic transmission interval is at the least one day, communication charges can be held down compared to the case of Fig. 26 (b).

【00319】 Furthermore, this embodiment is constituted such that an automatic transmission is performed only when the engine is initially started for the day, but the period can be set arbitrarily, and, for example, can also be set such that automatic transmission is performed only when the engine is initially started for the week.

【00320】 Further, this embodiment may be constituted such that an automatic transmission from the mobile work machine 31 is performed at engine starting time at a specified time period during the day (for example, for the time period 18:00 to 6:00) as shown in Fig. 26 (d).

【00321】 That is, as shown in Fig. 26 (a), when the engine is started at timing t4 within the time period of 18:00 to 6:00, and a signal indicating the engine is started is inputted to the communication terminal 56, this signal serves as a trigger, and, as indicated by arrow i, the current location of the mobile work machine 31 is incorporated into e-mail, and is sent to the communication satellite 9 as e-mail. Accordingly, a history of locations at a specified time period of the mobile work machine 31 is similarly displayed on a management-side terminal. Here, the specified time period (night-time) of 18:00 to 6:00 is a time period during which construction machine and other such mobile work machine are normally not operated. It is also a time period during which long-term movement is not carried out. There is the danger that the starting of the engine and the moving of the mobile work machine 31 during this specified time period signifies that some sort of abnormality has occurred. Since a history of the locations of the mobile work machine 31 during this specified time period are displayed on a management-side terminal, by monitoring this display screen, it is possible to make a determination as to the fact that some sort of abnormality has occurred to the mobile work machine 31.

【00322】 Further, this embodiment may also be constituted such that an automatic transmission from the mobile work machine 31 is performed at the timing at which the engine stops due to an abnormality as shown in Fig. 26 (e).

【00323】 Here, as shown in Fig. 2, an abnormality, which has occurred in the mobile work machine 31, for example, an abnormality such as "high engine speed," "high engine exhaust temperature," "high cooling water temperature," "low battery voltage," or "low fuel quantity" is detected by a predetermined sensor among a group of sensors 62. This sensor detection signal, as explained hereinabove, is inputted to the communication terminal 56 via the communication controller 54 by being described as an error code (for example, "Abnormal item: low fuel quantity") in a frame signal and sent out over the signal wire 52 by the electronic control controller 53. Furthermore, if the vehicle abnormality can be monitored by the communication terminal 56, then a well-known technology other than this method can also be utilized.

【00324】 As shown in Fig. 26 (a), when engine operation is stopped at timing t2, a stop signal indicating that the engine is stopped is inputted into the communication terminal

56. At this point, the above-mentioned error code is inputted into the communication terminal 56. And then, a determination is made as to whether or not the stop signal and error code were inputted at the same time. When the stop signal and error code are inputted at the same time, a determination is made that the engine was stopped due to an abnormality (malfunction), this stop signal serves as a trigger, and, as indicated by arrow g, the current location of the mobile work machine 31 is incorporated into e-mail, and is sent to the communication satellite 9 as e-mail. Accordingly, the location of the mobile work machine 31 is similarly displayed on a management-side terminal. According to this embodiment, since the location of a mobile work machine 31 is displayed on the terminal side only when an abnormality is detected and the engine is stopped, the location of the mobile work machine 31 at the time the abnormality occurred can be accurately grasped. Accordingly, the abnormality can be dealt with quickly, and the damage to the mobile work machine 31 can be held to the minimum.

【00325】 Further, an automatic transmission is not simply carried out when an abnormality occurs, but rather, this embodiment can also be constituted such that specific abnormality items (serious abnormality items) are set in advance among the abnormality items (error codes), and an automatic transmission is performed only when these serious abnormalities occur.

【00326】 Further, this embodiment can also be constituted such that an automatic transmission from the mobile work machine 31 is performed at the timing of engine start resulting from the annulment of an abnormality as shown in Fig. 26 (f).

【00327】 That is, as shown in Fig. 26 (a), when the engine is started at timing t3, a start signal indicating that the engine has started is inputted to the communication terminal 56. At this point, the above-mentioned error code is inputted into the communication terminal 56. When a serviceman takes the prescribed actions related to the abnormality, and the abnormality (malfunction) is annulled, the error code is not longer inputted into the communication terminal 56. A determination is made as to whether or not the engine started when the error code ceased to be inputted into the communication terminal 56. When the engine started at the time the error code ceased to be inputted into the communication terminal 56, it is determined that the abnormality (malfunction) was

annulled, and the engine was started, this start signal serves as a trigger, and, as indicated by arrow h, the current location of the mobile work machine 31 is incorporated into e-mail, and sent to the communication satellite 9 as e-mail. Accordingly, the location of the mobile work machine 31 is similarly displayed on a management-side terminal. According to this embodiment, since the location of the mobile work machine 31 is displayed on the terminal side only when an abnormality is annulled and the engine is started, it is possible to accurately grasp the location of the mobile work machine 31 when an abnormality was properly dealt with.

【00328】 Further, this embodiment can also be constituted such that specified mobile unit information, for example, the operation map (record showing engine operation from a certain hour and minute to a certain hour and minute) up until 23:00 of this day, is automatically transmitted from mobile work machine 31 at a specified time (for example, at 23:00). In accordance therewith, as shown in Fig. 30, an operation map for each day is displayed on a display screen of the terminal side.

【00329】 Further, this embodiment can also be constituted such that specified mobile unit information is automatically transmitted from mobile work machine 31 at a specified time every few days (for example, at 23:00 every third day).

【00330】 Further, this embodiment can also be constituted such that specified mobile unit information is automatically transmitted from mobile work machine 31 at a specified time each specified day of the week (for example, at 23:00 every Saturday).

【00331】 As described above, since specified mobile unit information is sent at a specified time, specified mobile unit information of mobile work machine 31 can be acquired regularly from a display screen of the terminal side.

【00332】 Further, when the cumulative value of the operating time of mobile work machine 31 constitutes a specified operating-time cumulative value, for example, when the absolute value of the service meter reaches 100 hours, 300 hours, or 500 hours, specified mobile unit information (for example, "service meter," "vehicle warning 1 (error code 1)," "vehicle warning 2 (error code 2)," "battery voltage," "engine water temperature," "engine speed," "pump pressure" or "oil quantity") can be automatically transmitted.

【00333】 Thus, since specified mobile unit information is sent when the cumulative operating time constitutes a specified operating-time cumulative value, preliminary information for carrying out regular inspections authorized by law can be acquired via a display screen of the terminal side. Further, since this specified operating-time cumulative value is automatically transmitted in accordance with the progress of operating time (load), wasteful communications can be avoided during rest periods, and communication costs can be held in check.

【00334】 Further, each time the cumulative value of the operating time of the mobile work machine 31 increases by a specified amount, for example, each time the incremental value of the service meter increases by 100 hours from the last automatic transmission (or each time 500 hours elapses), specified mobile unit information (for example, "service meter," "vehicle warning 1 (error code 1)," "vehicle warning 2 (error code 2)," "battery voltage," "engine water temperature," "engine speed," "pump pressure" or "oil quantity") can be automatically transmitted. Furthermore, setting the incremental value of the service meter can be done by matching it up with the patrol time of a service vehicle 34.

【00335】 Thus, since specified mobile unit information is sent each time the operating-time cumulative value increases by a specified amount, preliminary information for carrying out regular inspections authorized by law can be acquired via a display screen of the terminal side. Further, when this specified operating-time cumulative value is displayed on a management-side terminal, patrol instructions can readily be given to the service vehicle 34. Further, when this specified operating-time cumulative value is displayed on the terminal of the serviceman side, the mobile work machine requiring service can be readily specified, and service can be rapidly carried out by the service vehicle 34. Further, since this specified operating-time cumulative value is automatically transmitted in accordance with the progress of operating time (load), wasteful communications can be avoided during rest periods, and communication costs can be held in check.

【00336】 Many variations are possible regarding the above-described embodiment. Hereinbelow, explanations will be given with regard to Fig. 9, Fig. 10, Fig. 11, Fig. 12 and Fig. 14.

【00337】 The above-mentioned automatic transmission may be performed when

the location of mobile work machine 31 changes.

【00338】 The location of mobile work machine 31 is detected by the GPS sensor 57 as shown in Fig. 2. The detection results of the GPS sensor 57 are inputted into the communication controller 54. When a determination is made by the communication controller 54 that the location of mobile work machine 31 has changed, post-change location information is sent to the communication terminal 56 as transmission data. Then, e-mail, in which the location information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00339】 Thus, since location information is sent each time the location of the mobile work machine 31 changes, the movement history of the mobile work machine 31 can be acquired via a display screen of the terminal side.

【00340】 Further, this embodiment can also be constituted such that an automatic transmission is performed when mobile work machine 31 departs from a specified set range 129 as shown in Fig. 10.

【00341】 The location of the mobile work machine 31 is detected by the GPS sensor 57 as shown in Fig. 2. The detection results of the GPS sensor 57 are inputted into the communication controller 54. Work site location information is stored in the communication controller 54. This set range 129 of the work site is a circle of radius S(km). Accordingly, the detected location of the mobile work machine 31 is compared against the boundary location of the set range 129, and a determinations is made as to whether or not the mobile work machine 31 has departed from the set range 129. When the mobile work machine 31 reaches the boundary location J of the set range 129, the location information of the mobile work machine 31 at that time is sent to the communication terminal 56 as transmission data. Then, e-mail, in which the location information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00342】 Thus, since location information is sent when the mobile work machine 31 departs from the set range 129 (when it goes beyond a set location), monitoring whether or not the mobile work machine 31 is operating within a work site can be readily performed via a display screen on the terminal side. Further, the set range 129 is not limited to the

fixed range of a work site, but can also be a range having at its center a location, where the mobile work machine 31 was in the past. In other words, a set range can be updated in line with the passage of time.

【00343】 Further, the shape of a set range 129 is not limited to a circle, but rather can be an arbitrary shape, such as an elliptic, a square or a rectangle, or an elliptic or rectangle, which has the direction of travel of the mobile work machine 31 as the longitudinal direction.

【00344】 The set range 129 shown in Fig. 10 can also be a range equivalent to the normal range 117 shown in Fig. 23 (a).

【00345】 Further, this embodiment can also be constituted such that an automatic transmission is carried out when the quantity of change of the mobile work machine 31 movement location exceeds a set value as shown in Fig. 10.

【00346】 The location of the mobile work machine 31 is detected by the GPS sensor 57 as shown in Fig. 2. The detection results of the GPS sensor 57 are inputted into the communication controller 54 at a fixed sampling cycle. In the communication controller 54, the travel velocity V of a mobile work machine 31 is computed based on the difference value between the location detected last time and the location detected this time, and the sampling time. Accordingly, the travel velocity V of the mobile work machine 31 is compared against the set value V2 (Fig. 25), and a determination is made as to whether or not the travel velocity V of the mobile work machine 31 has exceeded the set value V2. When the travel velocity V of the mobile work machine 31 exceeds the set value V2, the location information of the mobile work machine 31 at that time is sent to the communication terminal 56 as transmission data. Then, e-mail, in which the location information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00347】 Thus, since location information is sent when the travel velocity V of the mobile work machine 31 exceeds the set value V2, monitoring the movement status of the mobile work machine 31 can be readily performed via a display screen of the terminal side. That is, construction machine and other such mobile work machine 31 travel at extremely low speeds. Therefore, if the set value V2 is set at a high speed not normally attainable by

a mobile work machine 31 traveling under its own power, for example, the speed when a trailer 35 cruises on an expressway, when the travel velocity V of the mobile work machine 31 exceeds the set value V2, a determination can be made that the mobile work machine 31 is being transported by a trailer 35. Further, when the mobile work machine 31 is being transported by a trailer at a time, and under conditions which transport is not normally carried out, it is possible to recognize that an abnormal situation has occurred, and it becomes possible to take appropriate action quickly.

【00348】 Further, this embodiment can also be constituted such that an automatic transmission is performed, when a service vehicle 34 enters a specified set range 125, 126 as shown in Fig. 9.

【00349】 The location of a service vehicle 34 is detected by the GPS sensor 57 as shown in Fig. 2. The detection results of the GPS sensor 57 are inputted into the communication controller 54. Location information of a destination 126, where the mobile work machine 31 targeted for service is located, and an access prohibited area 125 is stored in the communication controller 54. The set range 126 of this destination is a circle of a predetermined radius having the location of the mobile work machine 31 at its center. The access-prohibited area 125, for example, is a road under restriction due to heavy rains, or an area in which the foundation is not solid.

【00350】 Accordingly, the detected location of the service vehicle 34 is compared against the boundary location of a set range 125, 126, and a determination is made as to whether or not the service vehicle 34 has entered either set range 125 or 126. When the service vehicle 34 travels along route 127 or route 128, and reaches either boundary location H or I of set range 125 or 126, the location information of the service vehicle 34 at that time is sent to the communication terminal 56 as transmission data. Then, e-mail in which the location information is described is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00351】 Thus, since location information is sent when the service vehicle 34 enters either set range 125 or 126, monitoring of whether or not the service vehicle 34 has reached the destination, or whether or not it had entered the access-prohibited area can be readily performed via a display screen of the terminal side. That is, a manager can

perceive from the terminal display screen that the service vehicle 34 has reached the destination 126 and will commence service work, and, in addition, the manager can perceive a dangerous situation, in which the service vehicle 34 as entered an access-prohibited area 125. Thus, appropriate work instructions data (Message: "Return when finished," or "Avoid access-prohibited area") can be sent to the service vehicle 34 from a management-side terminal as described above (Refer to Fig. 4).

【00352】 Furthermore, the shape of the set range 126 of the destination is not limited to a circle, and can be an arbitrary shape, such as an elliptic, square or rectangle.

【00353】 Further, the set ranges 125, 126 shown in Fig. 9 can be ranges equivalent to the abnormal range 118 shown in Fig. 23 (b).

【00354】 Further, this embodiment can be constituted such that an automatic transmission is performed when the amount of data to be sent either accords with a set value or exceeds a set value as shown in Fig. 11.

【00355】 In a communication device, which utilizes a meter-rate billing system, the communication charge paid per usage is a fixed monthly amount up to a predetermined quantity of data Do as shown in Fig. 11 (a). When the quantity of data D exceeds a set value Do, it is necessary to pay additional charges in proportion to the quantity of excess data.

【00356】 Accordingly, specified mobile unit information, which is transmitted automatically from mobile work machine 31 is collected and stored in the communication controller 54. The stored data quantity D is compared against the set value (80% of Do) in the communication controller 54. Then, as shown in Fig. 11 (b), when the stored data quantity D coincides with the set value (80% of Do), stored mobile unit information is sent to the communication terminal 56 as transmission data. And then e-mail, in which the mobile unit information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00357】 Thus, since mobile unit information is sent when the data quantity D to be automatically transmitted coincides (or exceeds) the set value, the maximum quantity of mobile unit information within a fixed payment amount can be displayed on a display

screen of the terminal side.

【00358】 Further, this embodiment can also be constituted such that an automatic transmission is performed when the fuel quantity either coincides with a set value or is less than the set value as shown in Fig. 12 (a).

【00359】 Fuel quantity is detected by a group of sensors 62 inside mobile work machine 31, and sequentially sent to the communication controller 54. In the communication controller 54, the detected fuel quantity is compared against a set value. Then, as shown in Fig. 12 (a), when the detected fuel quantity coincides with the set value, mobile unit information ("location," "fuel quantity") is sent to the communication terminal 56 as transmission data. And then, e-mail, in which the mobile unit information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00360】 Thus, since mobile unit information is sent when the fuel quantity coincides with the set value (or is less than the set value), it is possible to perceive when the time has come to replenish the fuel from a display screen on the terminal side. For this reason, it is possible to send appropriate work instructions data (Message: "Replenish fuel") to a service vehicle 34, which carries out refueling patrol services, from a management-side terminal the same as in Fig. 3 and Fig. 4.

【00361】 Further, this embodiment can also be constituted such that an automatic transmission is performed when the voltage of the battery 63 either coincides with a set value or is less than the set value as shown in Fig. 12 (b).

【00362】 Battery 63 voltage values are detected by a group of sensors 62 inside mobile work machine 31, and sequentially sent to the communication controller 54. In the communication controller 54, the detected battery voltage is compared against a set value. Then, as shown in Fig. 12 (b), when the detected battery voltage coincides with the set value, mobile unit information ("location," "battery voltage") is sent to the communication terminal 56 as transmission data. And then, e-mail, in which the mobile unit information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00363】 Thus, since mobile unit information is sent when the voltage of the battery 63 coincides with the set value (or is less than the set value), it is possible to perceive when the time has come for maintenance and inspections, such as charging or replacing the battery 63, from a display screen on the terminal side. For this reason, it is possible to send appropriate work instructions data (Message: "Inspect battery") to a service vehicle 34 from a management-side terminal the same as in Fig. 3 and Fig. 4. Further, by perceiving on a display screen of the terminal side a state in which a battery 63 is nearly discharged, it is possible to subsequently send a request to turn ON the sleep function, and to make a setting such that mobile work machine 31 communications are only carried out intermittently, thus curbing further discharge.

【00364】 Further, an embodiment, in which an automatic transmission is not performed when the content of the mobile unit information automatically transmitted the last time is the same as the content of the mobile unit information to be automatically transmitted this time, is also possible.

【00365】 As shown in Fig. 2, an abnormality, which occurs in mobile work machine 31, for example, an abnormality such as "high engine speed," "high engine exhaust temperature," "high cooling water temperature," "low battery voltage" or "low fuel quantity," is detected by a prescribed sensor from among a group of sensors 62. The detection signals of this sensor are sequentially inputted to the communication controller 54 by being described as an error code (for example, "Abnormal item: low fuel quantity") in a frame signal and sent out over the signal wire 52 by the electronic control controller 53.

【00366】 In the communication controller 54, the error code automatically transmitted last time is compared against the currently inputted error code. Then, only when the content of the error code automatically transmitted last time differs from the currently inputted error code is the currently inputted error code sent to the communication terminal 56 as transmission data. And then, e-mail, in which the mobile unit information is described, is automatically transmitted from the communication terminal 56 via the satellite communication antenna 58.

【00367】 Thus, since an automatic transmission is performed only when the content of the error code automatically transmitted last time differs from the error code to be

automatically transmitted this time, and automatic transmission is not performed when the content of the error code automatically transmitted last time is the same as the error code to be automatically transmitted this time, it is possible to avoid the uselessness of transmitting the same information a plurality of times. Further, the same also holds true for the automatic transmission of mobile unit information other than error codes.

【00368】 Further, in the embodiment described hereinabove, when a parameter inside a mobile unit constitutes a specified value, specified mobile unit information is automatically transmitted, but an embodiment, which arbitrarily changes the content of a "parameter" (stored data, such as the quantity of data D, and sensor detected data, such as battery voltage), a "specified value" or "specified mobile unit information" in this case from, for example, a management-side terminal (server terminal 21, terminal 11), is also possible. In this case, as explained hereinabove, e-mail describing change-data to the effect that the above-mentioned parameter is to be changed is sent from a terminal to the mobile work machine 31 having this mobile work machine 31 as the e-mail address. And then, the change-data described in the e-mail is read out in the communication terminal 56 of the transmission-destination mobile work machine 31, and the parameter is changed in accordance with the content of this change-data.

【00369】 For example, when the service meter of the mobile work machine 31 goes beyond a predetermined value (when the mobile work machine 31 becomes obsolete), the interval between monitoring is shortened, and when the mobile work machine 31 is rented to a certain user (when there is no need for monitoring), or when it is resting for a long time (when it is clear that operation has stopped), the content of "parameter," "specified value," "specified mobile unit information" are changed such that the interval between monitoring is lengthened, and wasteful power consumption and communication charges are reduced. Furthermore, it is also possible to simultaneously change to the same content for a plurality of mobile units, which are working and traveling as a group. For example, with regard to "specified mobile unit information," the content can be reduced to only essential monitoring items.

【00370】 Thus, according to this embodiment, it is possible to change a time period and content to be automatically transmitted via a remote operation at the terminal

side while monitoring the status of a mobile unit and the surrounding situation. Thus, it is not necessary to dispatch a worker to the respective sites of mobile units 31, 32 and so forth to perform the changing work, greatly reducing the workload.

【00371】 Furthermore, when the mobile unit information to be sent out via an automatic transmission is the location of a mobile unit, the longitude and latitude on a map can also be sent as the location information, or a relative location in relation to specified criteria can also be sent as the location information.

【00372】 Further, the quantity of change in the voltage of a battery 63 can be automatically transmitted instead of automatically transmitting a voltage value of the battery 63 as mobile unit information.

【00373】 Further, operational load information, quantity of work, and quantity of fuel consumed can also be automatically transmitted as mobile unit information.

【00374】 As explained hereinabove, according to this embodiment, when a specified parameter reaches a specified value, it is possible to comprehend specified mobile unit information on a display screen of the terminal side without having to perform a request input operation on one's own at the terminal side. Accordingly, it is possible to recognize an abnormal condition (for example, a malfunction), which occurs in a mobile unit, which cannot be constantly managed and monitored, and it is possible to accurately comprehend the operating states and resting states of the mobile unit.

【00375】 This automatic transmission embodiment is not limited to the communication device shown in Fig. 1, and can be applied to an arbitrary communication device. If a communication device comprises at a minimum two communication stations, and performs communications between two communication stations, then this embodiment is applicable.

【00376】 Furthermore, in the embodiment explained hereinabove, communication means 1 comprising the Internet 2 are supposed, but communication means 1 of the present invention are not limited thereto, and can also be constituted by communication means, which do not comprise the Internet 2. In other words, if communications are performed the same as explained in the embodiment, it is possible to substitute another communication

means. Further, in this embodiment, communication means 1, which combine radio communications and wire communications, are supposed, but, of course, radio communications alone can be used, or wire communications alone can be used.

【00377】 Furthermore, in this embodiment, a presentation format, which displays mobile unit information on a terminal as image data, is supposed, but for the present invention, mobile unit information can also be presented by being outputted to a terminal by voice, and can also be printed out on a terminal as printed data. In other words, the presentation format of mobile unit information on a terminal is arbitrary.

【00378】 Further, in this embodiment, it is supposed, for the most part, that a plurality of mobile units comprising construction machine are managed and monitored, but the present invention is not limited to this, and can also be applied to cases in which ordinary automobiles, two-wheeled vehicles and the like are managed and monitored.

【Brief description of the drawings】

【Fig. 1】

Fig. 1 is a diagram showing a communication device of this embodiment.

【Fig. 2】

Fig. 2 is a diagram showing the constitution of the body of a mobile unit of an embodiment.

【Fig. 3】

Fig. 3 is a diagram showing an example of a screen display of a display device mounted on a mobile unit.

【Fig. 4】

Fig. 4 is a diagram showing an example of a screen display of a display device mounted on a mobile unit.

【Fig. 5】

Fig. 5 is a diagram showing an example of a screen display of a display device mounted on a mobile unit.

【Fig. 6】

Fig. 6 is a diagram showing the circumstances under which a camera-equipped mobile unit is performing work.

【Fig. 7】

Figs. 7(a) to 7(c) are timing charts illustrating a power-saving operation performed by a mobile unit.

【Fig. 8】

Figs. 8(a) to 8(c) are diagrams used for explaining an embodiment in which a power-saving operation is performed.

【Fig. 9】

Fig. 9 is a diagram illustrating the circumstances under which an automatic transmission is made from a mobile unit.

【Fig. 10】

Fig. 10 is a diagram illustrating the circumstances under which an automatic transmission is made from a mobile unit.

【Fig. 11】

Fig. 11 is a graph used for explaining an embodiment in which an automatic transmission is made from a mobile unit.

【Fig. 12】

Figs. 12(a) and 12(b) are graphs used for explaining an embodiment in which an automatic transmission is made from a mobile unit.

【Fig. 13】

Figs. 13(a) to 13(c) are diagrams used for explaining an embodiment in which a power-saving operation is performed.

【Fig. 14】

Fig. 14 is a flowchart showing the processing procedures when an automatic transmission from a mobile unit is performed.

【Fig. 15】

Fig. 15 is a flowchart showing the processing procedures for causing a display to transition in accordance with a communication state.

【Fig. 16】

Figs. 16(a) to 16(d) are diagrams illustrating the circumstances under which the display mode of an icon of a mobile unit changes in accordance with the communication status.

【Fig. 17】

Figs. 17(a) to 17(c) are diagrams illustrating the circumstances under which data is sequenced in accordance with the communication status.

【Fig. 18】

Fig. 18 is a flowchart showing the processing procedures for causing a display to transition in accordance with the communication status.

【Fig. 19】

Fig. 19 is a flowchart showing the processing procedures for causing a display to transition in accordance with the communication status.

【Fig. 20】

Fig. 20 is a flowchart showing the processing procedures for causing a display to transition in accordance with the communication status.

【Fig. 21】

Fig. 21 is a diagram showing the connection mode between an in-vehicle communication terminal and another machine.

【Fig. 22】

Fig. 22 is a diagram showing the connection mode between an in-vehicle communication terminal and another machine.

【Fig. 23】

Figs. 23(a) to 23(d) are diagrams illustrating the circumstances under which the duty ratio of a power-saving operation changes.

【Fig. 24】

Figs. 24(a) and 24(b) are diagrams illustrating the circumstances under which the duty ratio of a power-saving operation changes.

【Fig. 25】

Fig. 25 is a graph showing the circumstances under which the start-up period of a communication terminal changes.

【Fig. 26】

Figs. 26(a) to 26(f) are timing charts illustrating the circumstances under which an automatic transmission is performed from a mobile unit.

【Fig. 27】

Fig. 27 is a diagram showing an example of a display on a terminal display screen.

【Fig. 28】

Fig. 28 is a diagram showing an example of a display on a terminal display screen.

【Fig. 29】

Fig. 29 is a diagram showing an example of a display on a terminal display screen.

【Fig. 30】

Fig. 30 is a diagram showing an example of a display on a terminal display screen.

【Fig. 31】

Fig. 31 is a diagram showing an example of a display on a terminal display screen.

【Fig. 32】

Fig. 32 is a diagram showing an example of a display on a terminal display screen.

【Fig. 33】

Fig. 33 is a sequence diagram showing the processing procedures of communication control of the embodiment.

【Explanation of reference symbols】

1. Communication means (Internet 2, network control station 7, satellite earth station 8, feeder line 4, communication satellite 9, wireless communication channel 5)

11, 12 Terminal

21, 22 Server terminal

31 - 35 Mobile unit (mobile work machine 31 - 33, service car 34, mobile work machine

transport vehicle 35)

55 Car navigation system

56 Communication terminal

57 GPS sensor

60 Camera

62 Group of sensors

【Name of document】 Abstract

【Abstract】

【Subject】

To know about an abnormal state (such as robbery) occurring in a mobile unit, which cannot be constantly managed and monitored by the terminal side, and to accurately comprehend an operating state, and a resting state of a mobile unit.

【Constitution】

Communications are carried out between a mobile unit 31 and a terminal device 11, and when instructions requesting mobile unit 31 data are sent to the mobile unit 31 from the terminal device 11, mobile unit 31 data is sent to the terminal device 11 from the mobile unit 31. Meanwhile, in the mobile unit 31, a mobile unit internal parameter, for example, the engine start-up state, is detected by detecting means (for example, a sensor for detecting an alternator voltage value). Then, when the detection output of detecting means constitutes a specified value (state of engine at start-up), mobile unit information is sent to the terminal device 11 from the mobile unit 31.

【Selected drawing】 Fig. 26

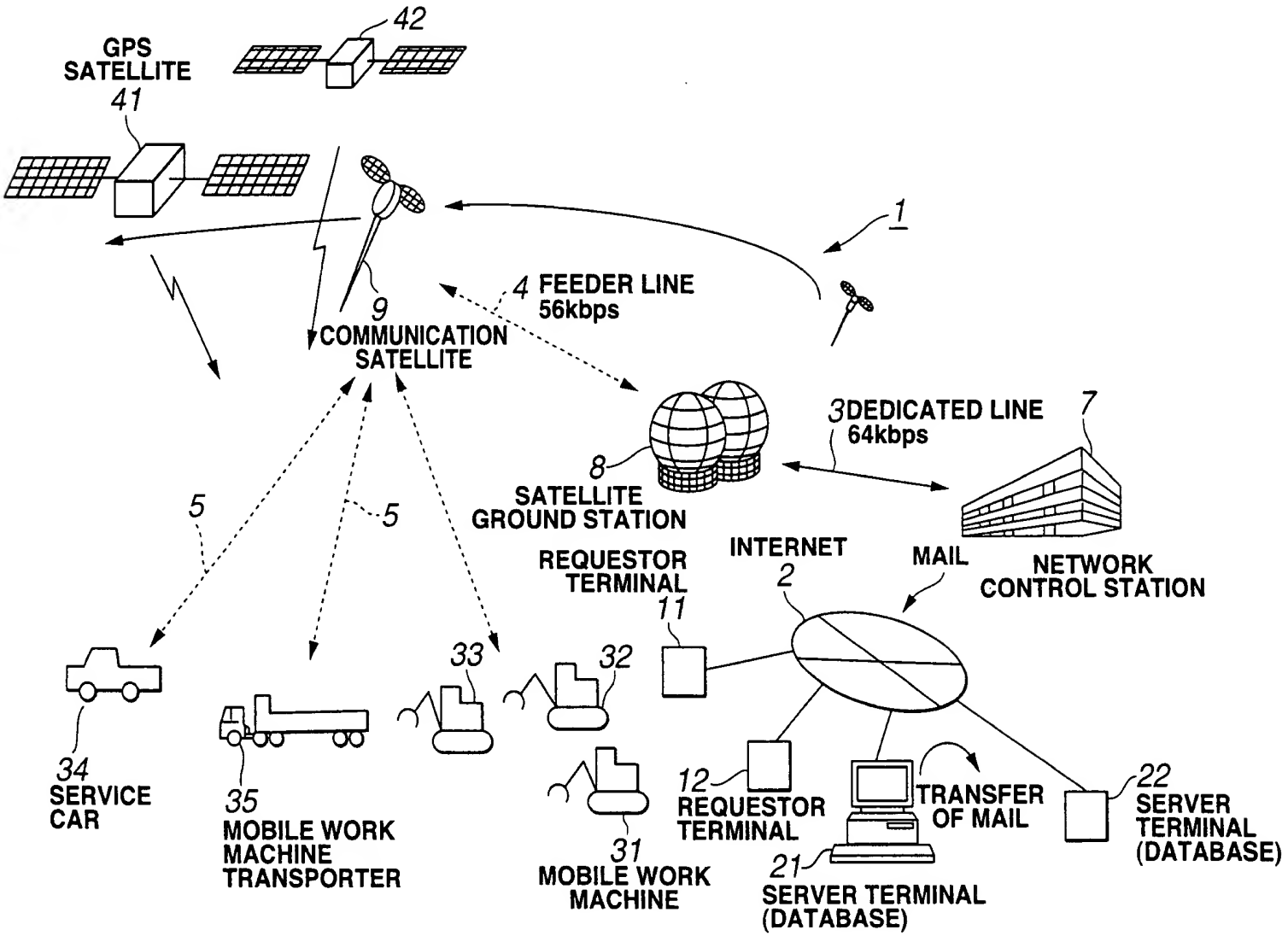


FIG.1

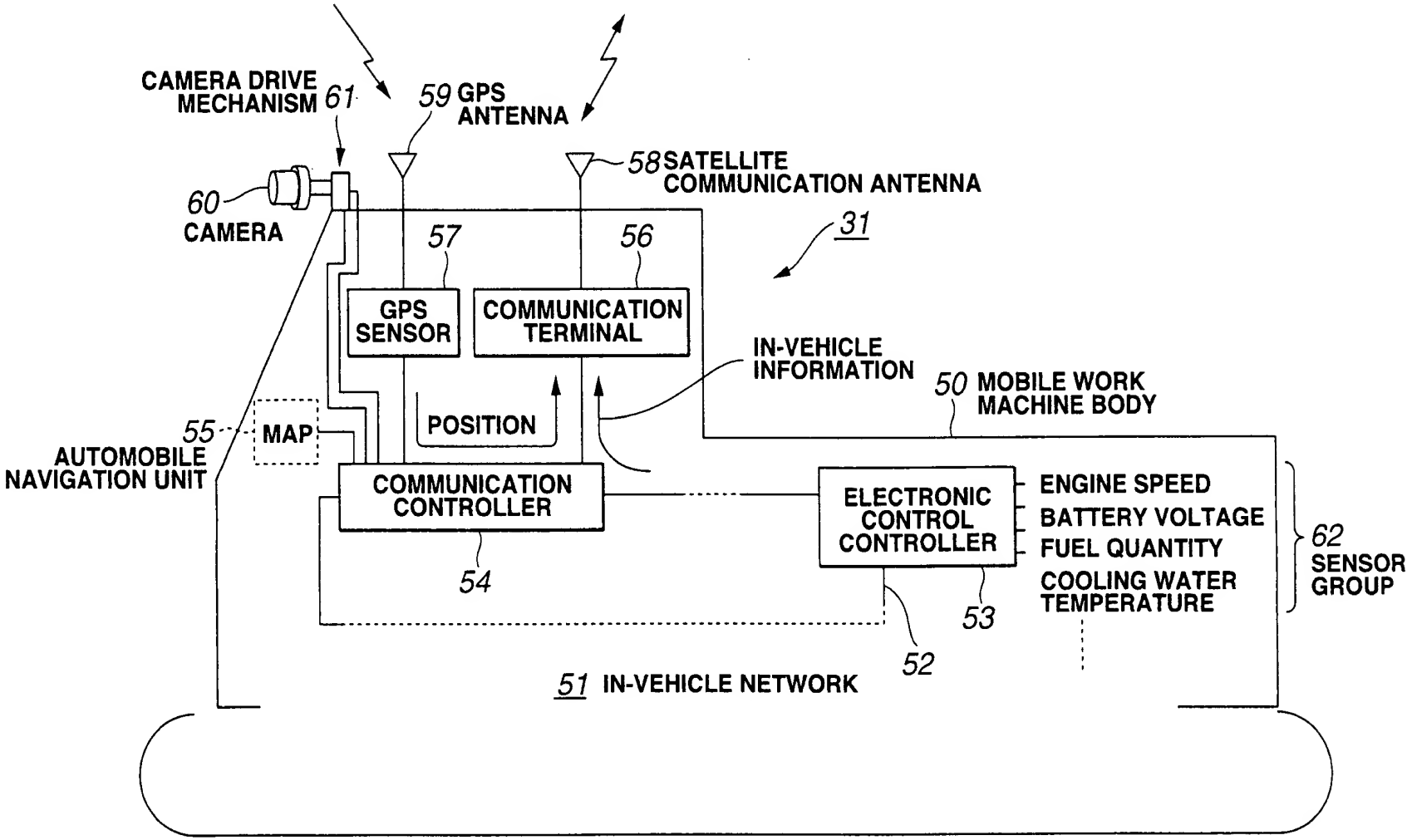

CAMERA DRIVE MECHANISM
61
59 GPS ANTENNA
58 SATELLITE COMMUNICATION ANTENNA
60
CAMERA
57
56
31
GPS SENSOR
COMMUNICATION TERMINAL
IN-VEHICLE INFORMATION
50 MOBILE WORK MACHINE BODY
55
MAP
AUTOMOBILE NAVIGATION UNIT
POSITION
COMMUNICATION CONTROLLER
ELECTRONIC CONTROL CONTROLLER
ENGINE SPEED
BATTERY VOLTAGE
FUEL QUANTITY
COOLING WATER TEMPERATURE
62
SENSOR GROUP
54
53
52
51 IN-VEHICLE NETWORK

FIG.2

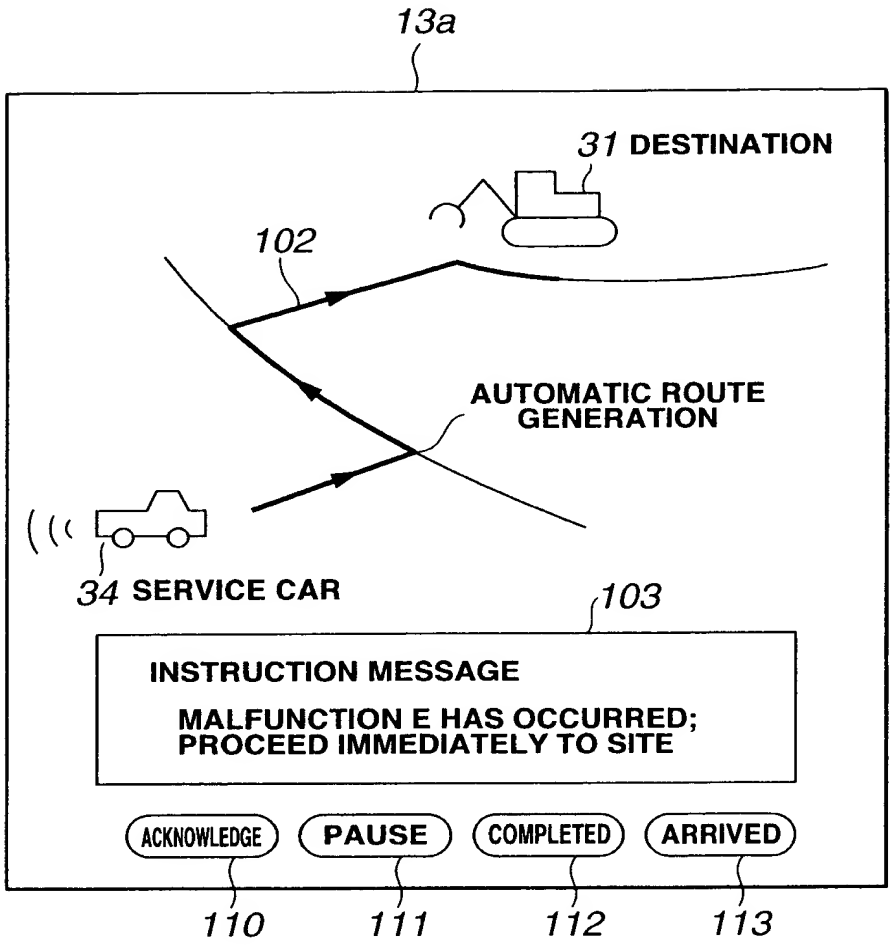

13a
31 DESTINATION
102
AUTOMATIC ROUTE GENERATION
34 SERVICE CAR
103
INSTRUCTION MESSAGE
MALFUNCTION E HAS OCCURRED; PROCEED IMMEDIATELY TO SITE
ACKNOWLEDGE
PAUSE
COMPLETED
ARRIVED
110
111
112
113

FIG.3

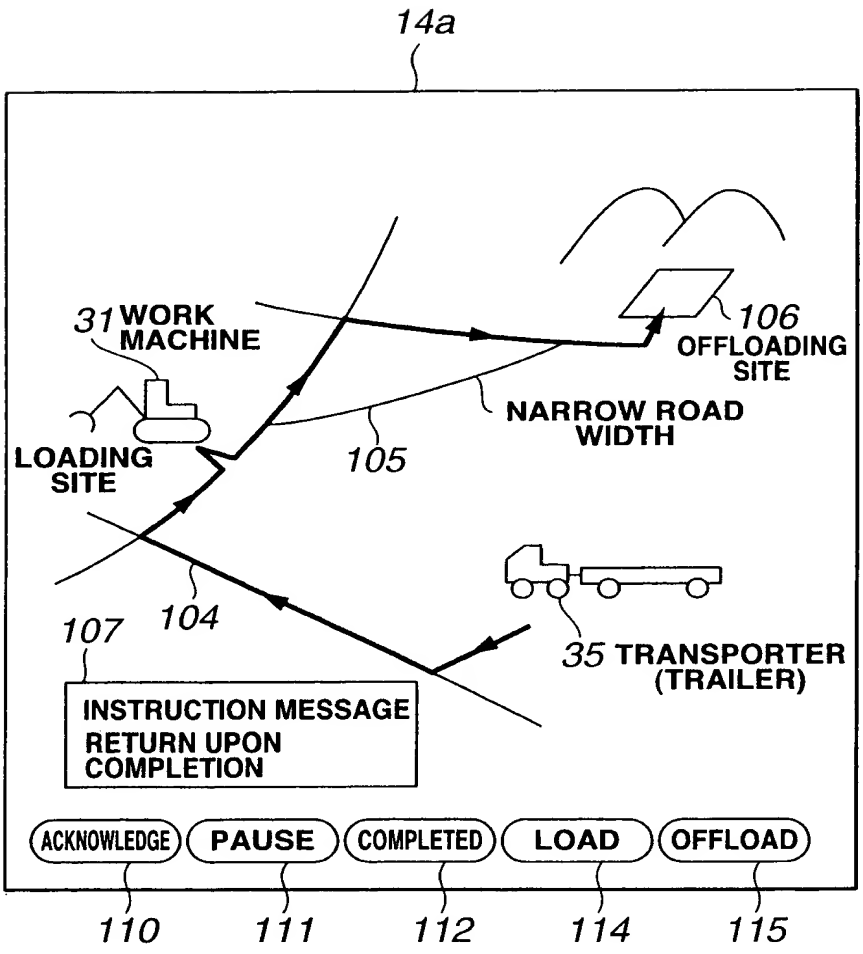

14a
31 WORK MACHINE
106 OFFLOADING SITE
NARROW ROAD WIDTH
LOADING SITE
105
104
107
35 TRANSPORTER (TRAILER)
INSTRUCTION MESSAGE RETURN UPON COMPLETION
ACKNOWLEDGE
PAUSE
COMPLETED
LOAD
OFFLOAD
110
111
112
114
115

FIG.4

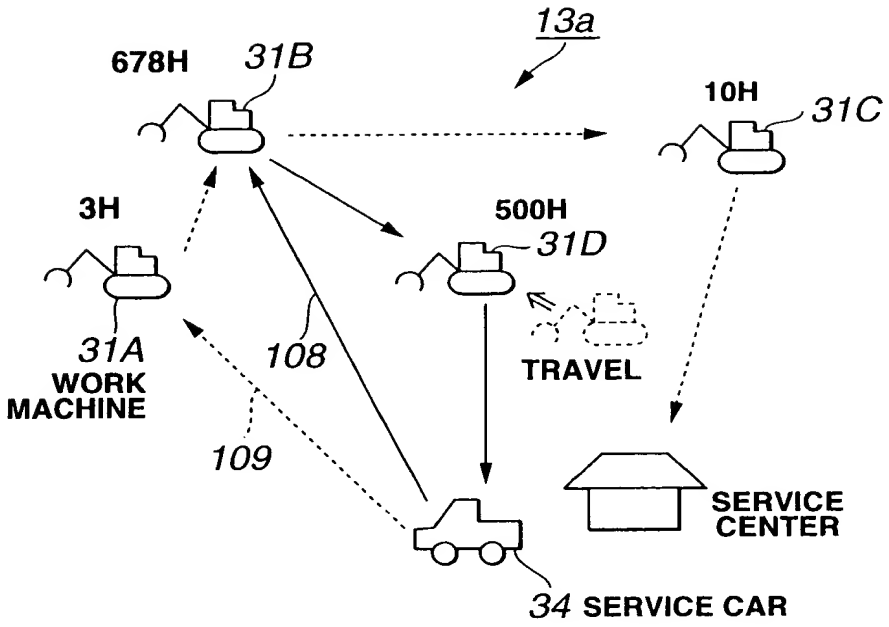

13a
678H
31B
10H
31C
3H
500H
31D
31A
WORK
MACHINE
108
109
TRAVEL
SERVICE
CENTER
34 SERVICE CAR

FIG.5

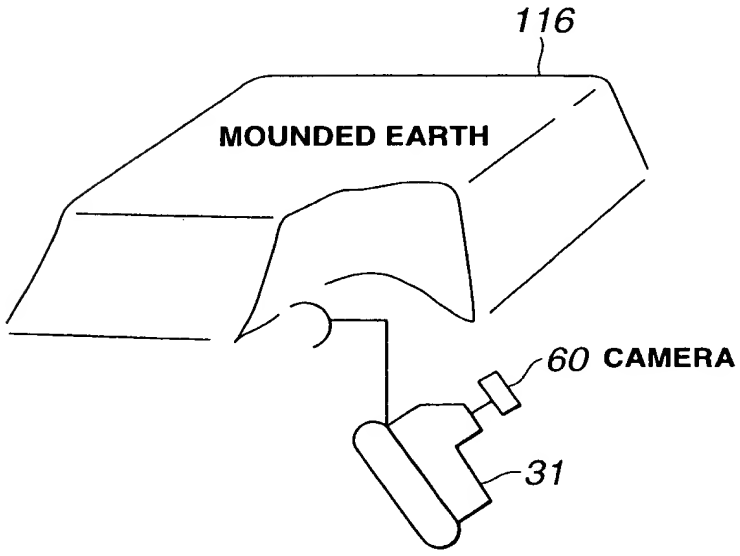

116
MOUNDED EARTH
60 CAMERA
31

FIG.6

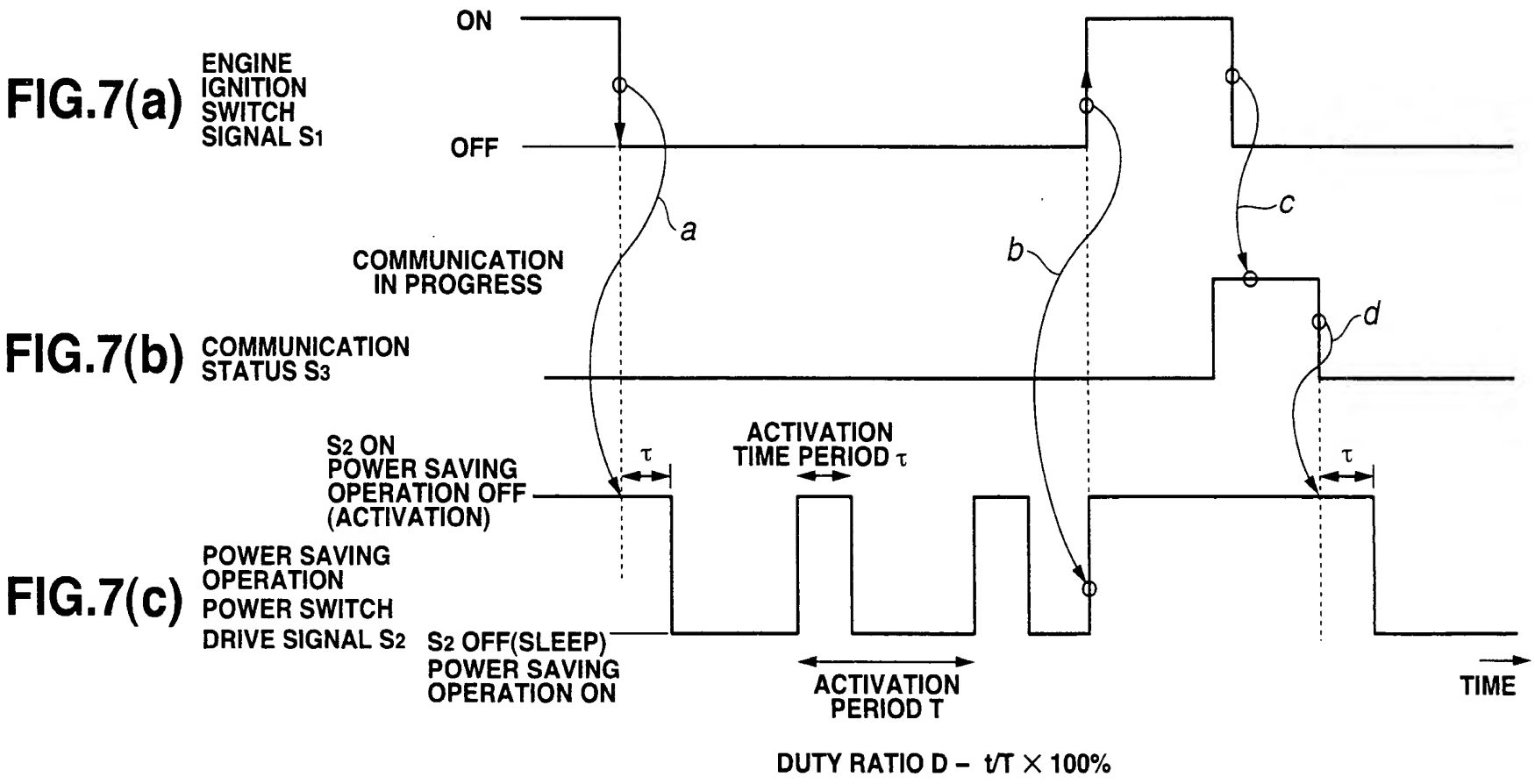


FIG.7(a)
ENGINE IGNITION SWITCH SIGNAL S1
ON
OFF
a
b
c
d
FIG.7(b)
COMMUNICATION STATUS S3
COMMUNICATION IN PROGRESS
FIG.7(c)
POWER SAVING OPERATION POWER SWITCH DRIVE SIGNAL S2
S2 ON POWER SAVING OPERATION OFF (ACTIVATION)
S2 OFF(SLEEP) POWER SAVING OPERATION ON
τ
ACTIVATION TIME PERIOD τ
ACTIVATION PERIOD T
TIME
DUTY RATIO D = t/T × 100%

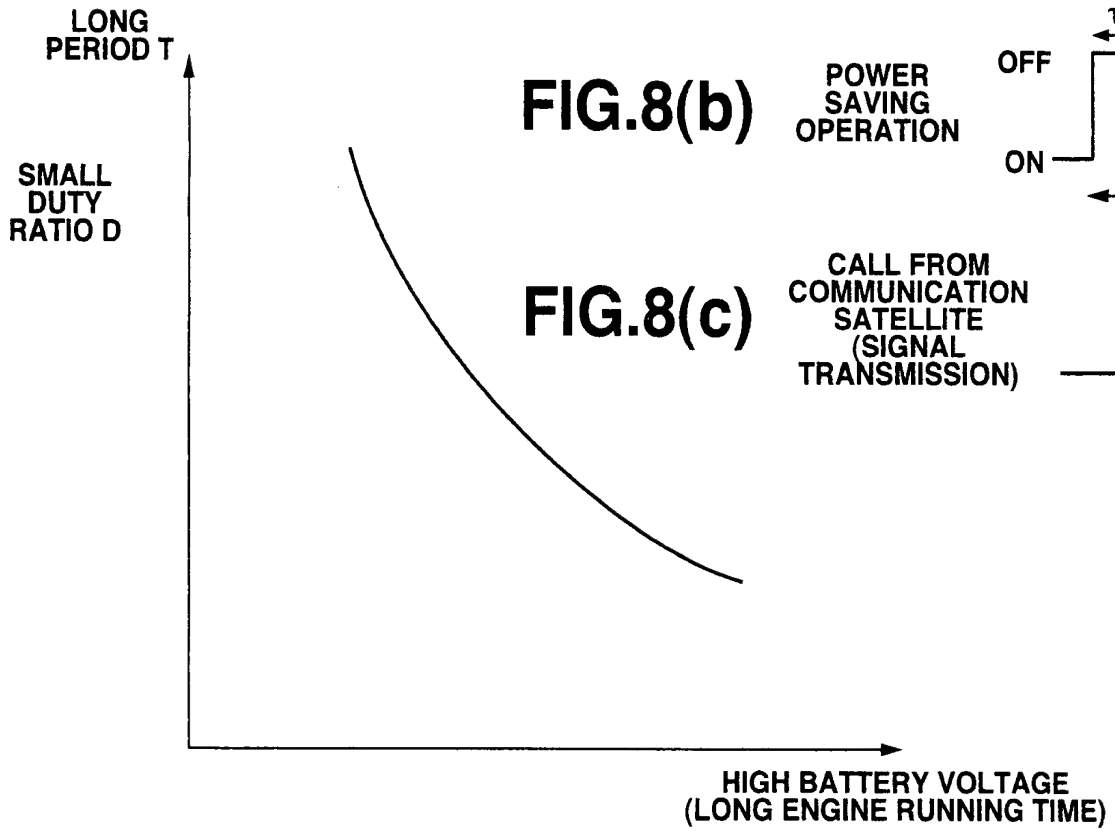


FIG.8(a)

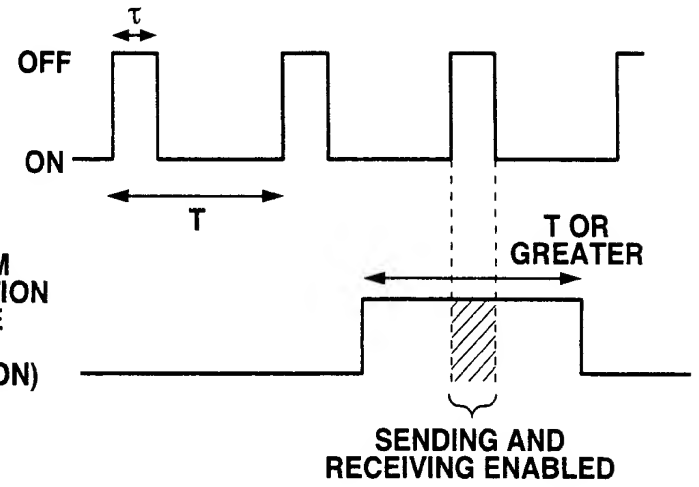


FIG.8(b) POWER SAVING OPERATION

FIG.8(c) CALL FROM COMMUNICATION SATELLITE (SIGNAL TRANSMISSION)

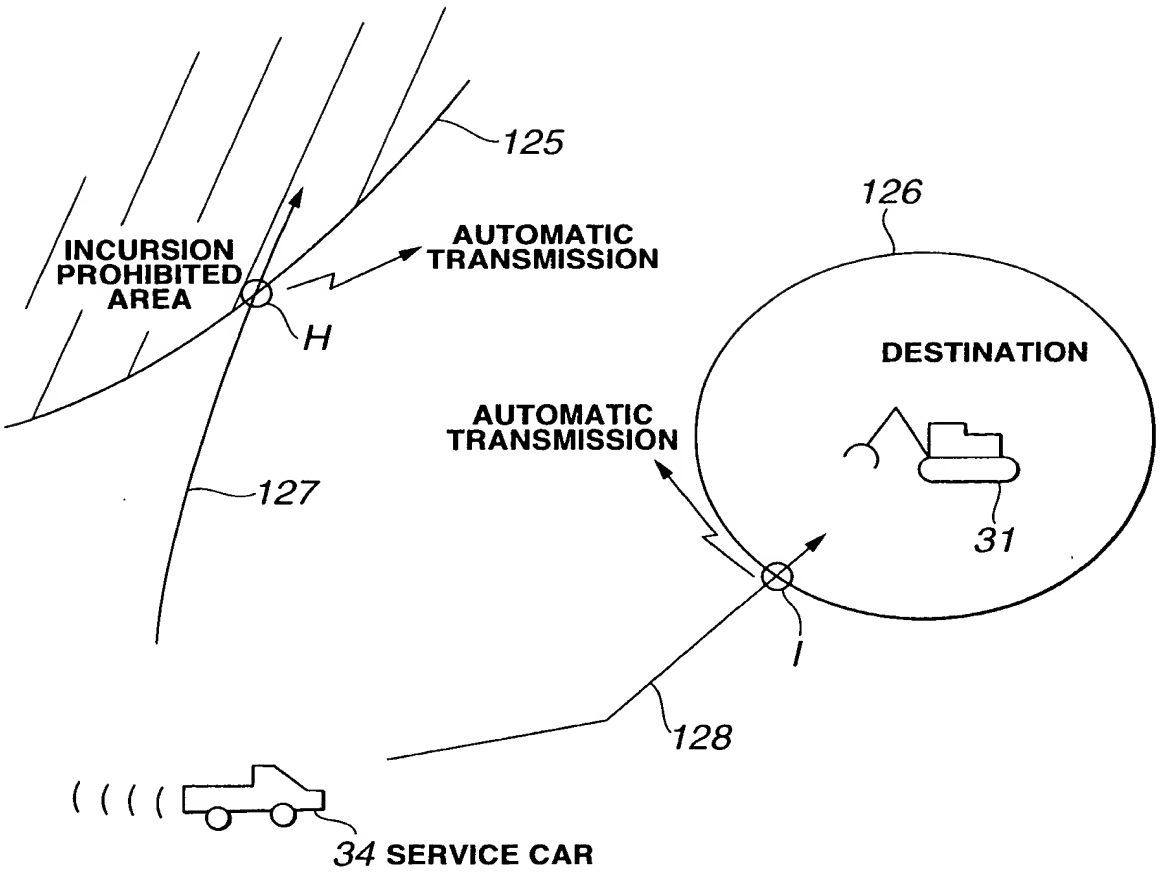

125
126
INCURSION PROHIBITED AREA
AUTOMATIC TRANSMISSION
H
DESTINATION
AUTOMATIC TRANSMISSION
127
31
I
128
34 SERVICE CAR

FIG.9

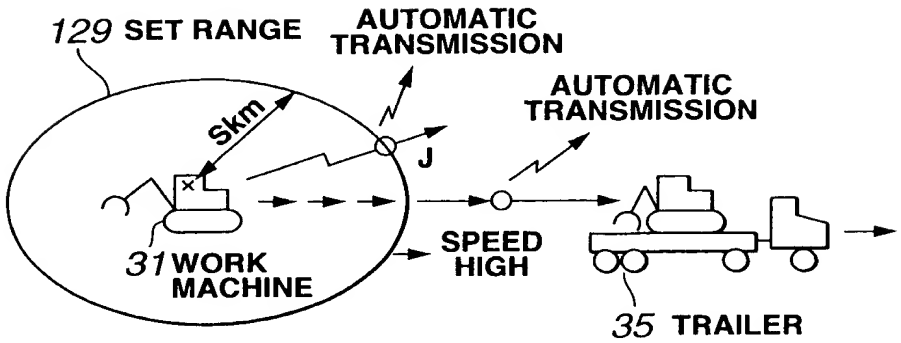


FIG.10

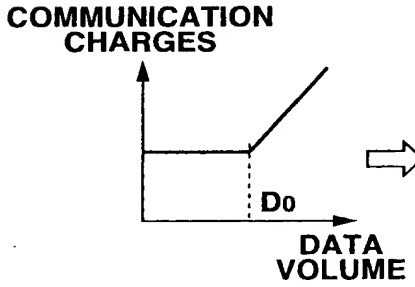


FIG.11(a)

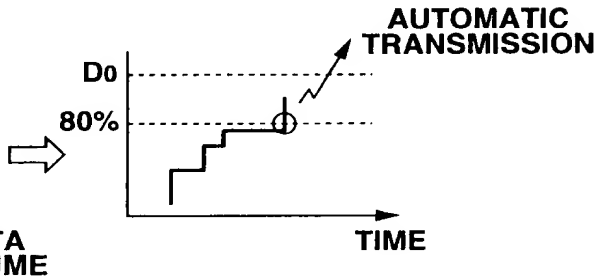


FIG.11(b)

FIG.12(a)

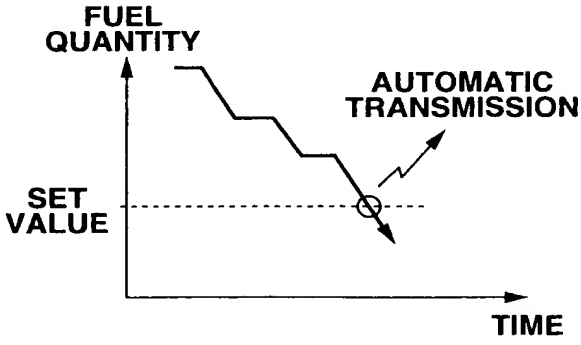
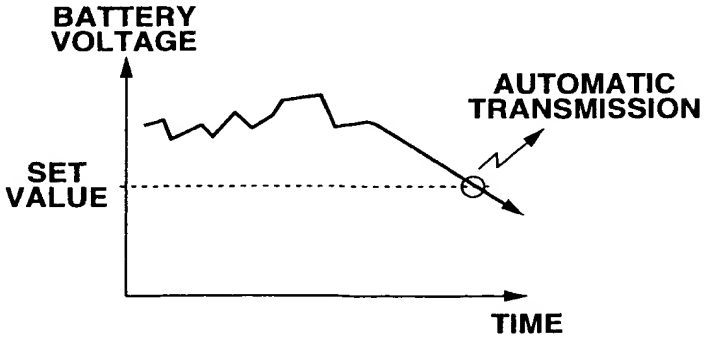
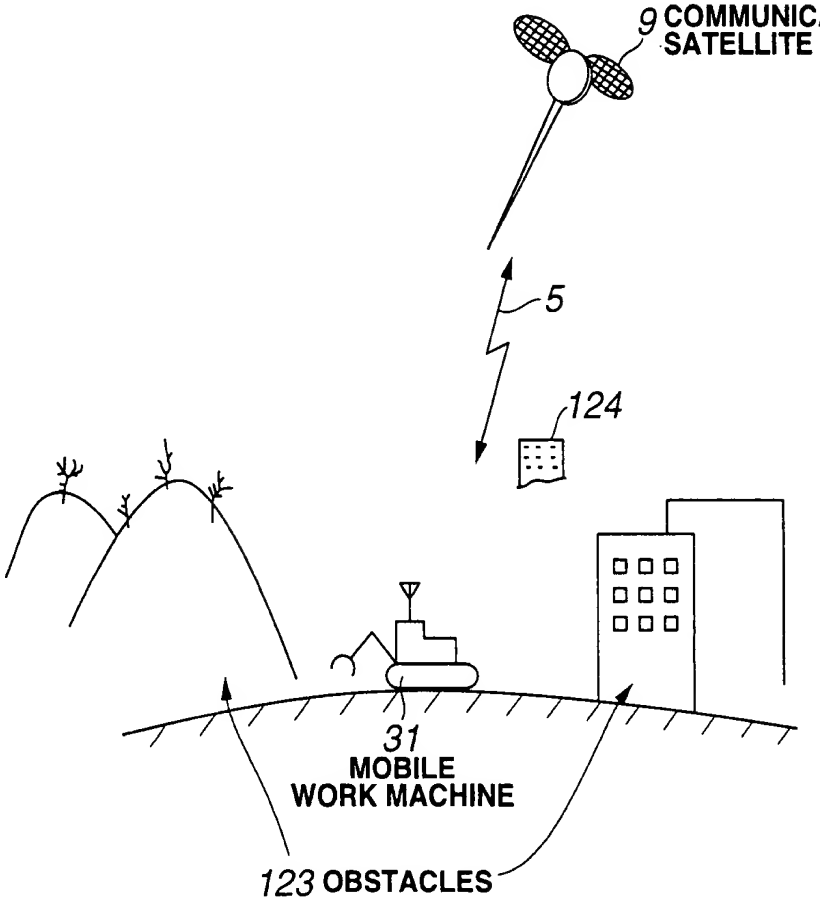


FIG.12(b)





ACTIVATION BASED ON SATELLITE ORBITAL INFORMATION

FIG.13(a)

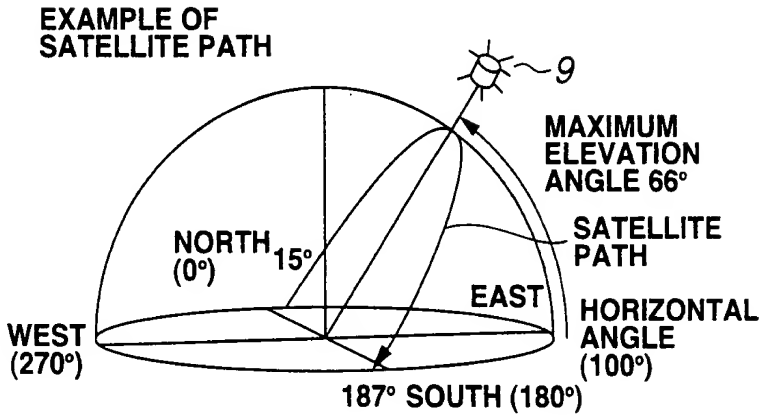


FIG.13(c)

DATE	TIME			AZIMUTH ANGLE		MAXIMUM ELEVATION ANGLE	
	AOS	MEL	LOS	AOS	MEL	LOS	MEL
24Aug98	0244	0247	0251	59	66	116	3
(MON)	0426	0433	0441	15	100	187	66
	0613	1618	1624	345	297	246	12
	1435	1443	1451	128	62	2	24
	1619	1628	1636	179	265	341	54
	1808	1814	1819	239	276	306	4

AOS TIME AND AZIMUTH AT WHICH SATELLITE APPEARS ON HORIZON

LOS TIME AND AZIMUTH AT WHICH SATELLITE DISAPPEARS BELOW HORIZON

MEL TIME AND AZIMUTH AT MAXIMUM ELEVATION ANGLE

FIG.13(b)

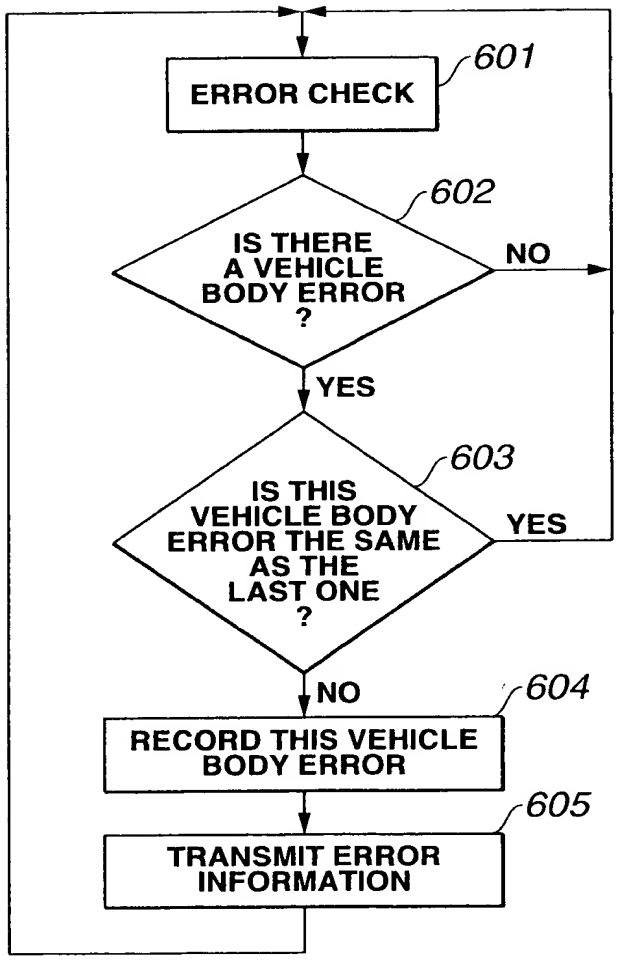

601
ERROR CHECK
602
IS THERE A VEHICLE BODY ERROR ?
NO
YES
603
IS THIS VEHICLE BODY ERROR THE SAME AS THE LAST ONE ?
YES
NO
604
RECORD THIS VEHICLE BODY ERROR
605
TRANSMIT ERROR INFORMATION

FIG.14

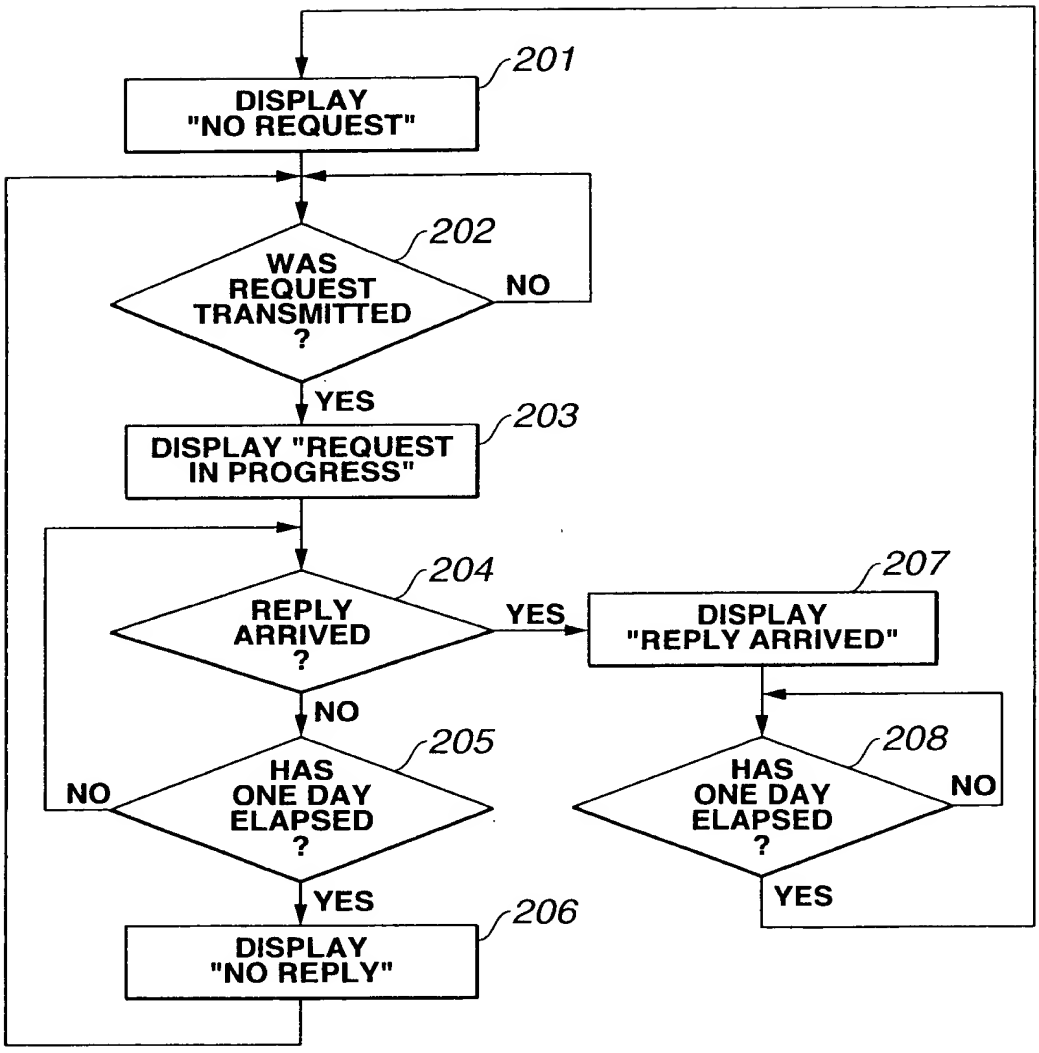

201
DISPLAY "NO REQUEST"
202
WAS REQUEST TRANSMITTED ?
NO
YES
203
DISPLAY "REQUEST IN PROGRESS"
204
REPLY ARRIVED ?
YES
207
DISPLAY "REPLY ARRIVED"
NO
205
HAS ONE DAY ELAPSED ?
NO
208
HAS ONE DAY ELAPSED ?
NO
YES
YES
206
DISPLAY "NO REPLY"

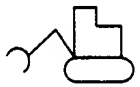
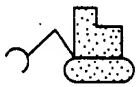
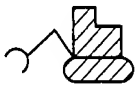
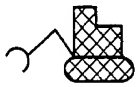
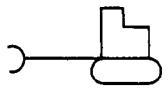
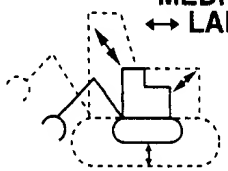
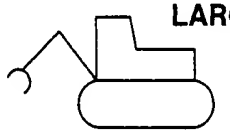
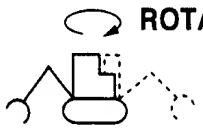
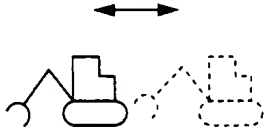
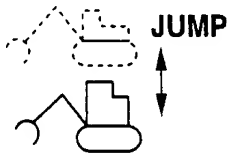
FIG.15

FIG.16(a)

FIG.16(b)

FIG.16(c)

FIG.16(d)

	NO REQUEST	REQUEST IN PROGRESS	REPLY ARRIVED	NO REPLY
COLOR (PATTERN)	 BLUE	 YELLOW	 GREEN	 RED
SHAPE				
SIZE	MEDIUM 	MEDIUM ↔ LARGE 	LARGE 	SMALL 
CHANGE		ROTATION 	MOVEMENT 	JUMP 

	COMMUNICATION STATUS	VEHICLE NUMBER	POSITION	SERVICE METER
33	BLUE	23	TOWN A	405H
31	YELLOW	102	CITY B	120H
36	BLUE	117	TOWN C	97H
37	BLUE	233	CITY D	381H
32	YELLOW	234	TOWN E	39H

FIG.17(a)

REARRANGE ACCORDING TO COMMUNICATION STATUS

	COMMUNICATION STATUS	VEHICLE NUMBER	POSITION	SERVICE METER
31	YELLOW	102	CITY B	120H
32	YELLOW	234	TOWN E	39H
33	BLUE	23	TOWN A	405H
36	BLUE	117	TOWN C	97H
37	BLUE	233	CITY D	381H

FIG.17(b)

EXTRACT

	COMMUNICATION STATUS	VEHICLE NUMBER	POSITION	SERVICE METER
31	YELLOW	102	CITY B	120H
32	YELLOW	234	TOWN E	39H

FIG.17(c)

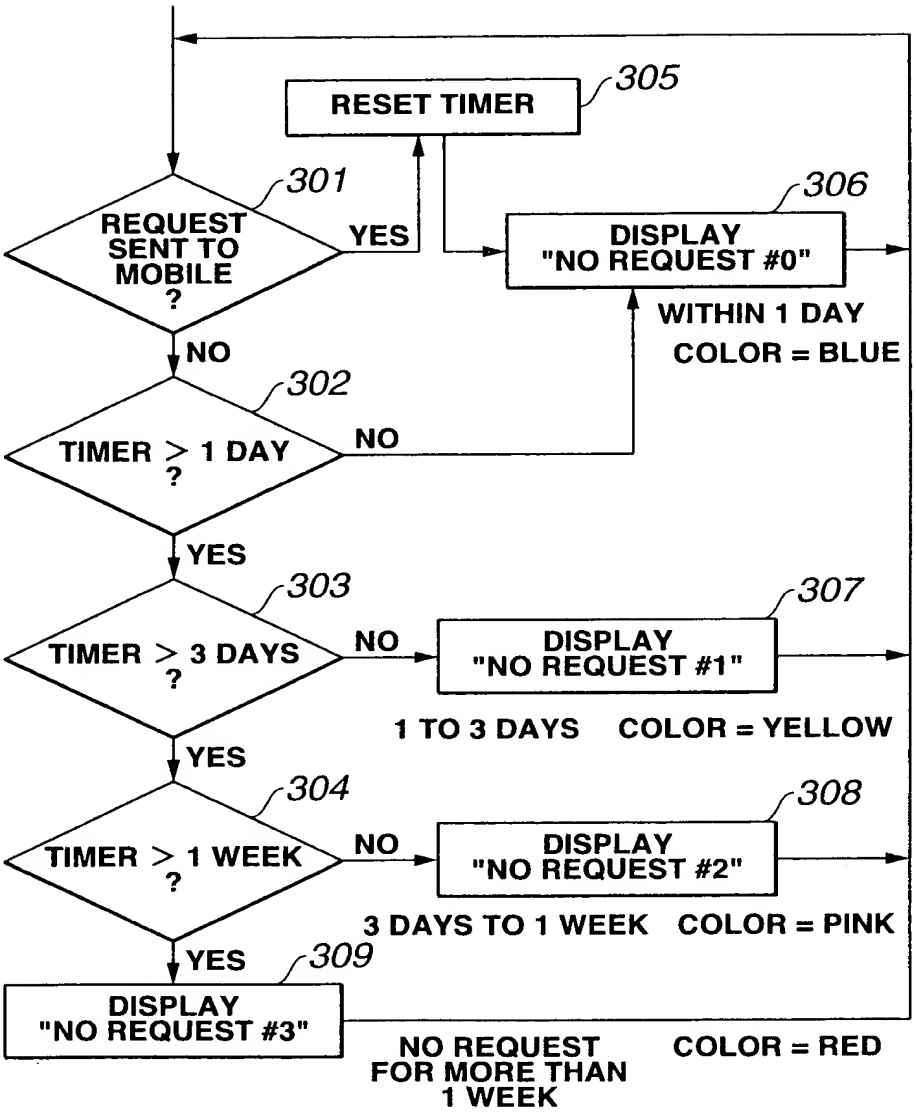

RESET TIMER
305
301
REQUEST SENT TO MOBILE ?
YES
306
DISPLAY "NO REQUEST #0"
WITHIN 1 DAY
COLOR = BLUE
NO
302
TIMER > 1 DAY ?
NO
YES
303
TIMER > 3 DAYS ?
NO
307
DISPLAY "NO REQUEST #1"
1 TO 3 DAYS
COLOR = YELLOW
YES
304
TIMER > 1 WEEK ?
NO
308
DISPLAY "NO REQUEST #2"
3 DAYS TO 1 WEEK
COLOR = PINK
YES
309
DISPLAY "NO REQUEST #3"
NO REQUEST FOR MORE THAN 1 WEEK
COLOR = RED

FIG.18

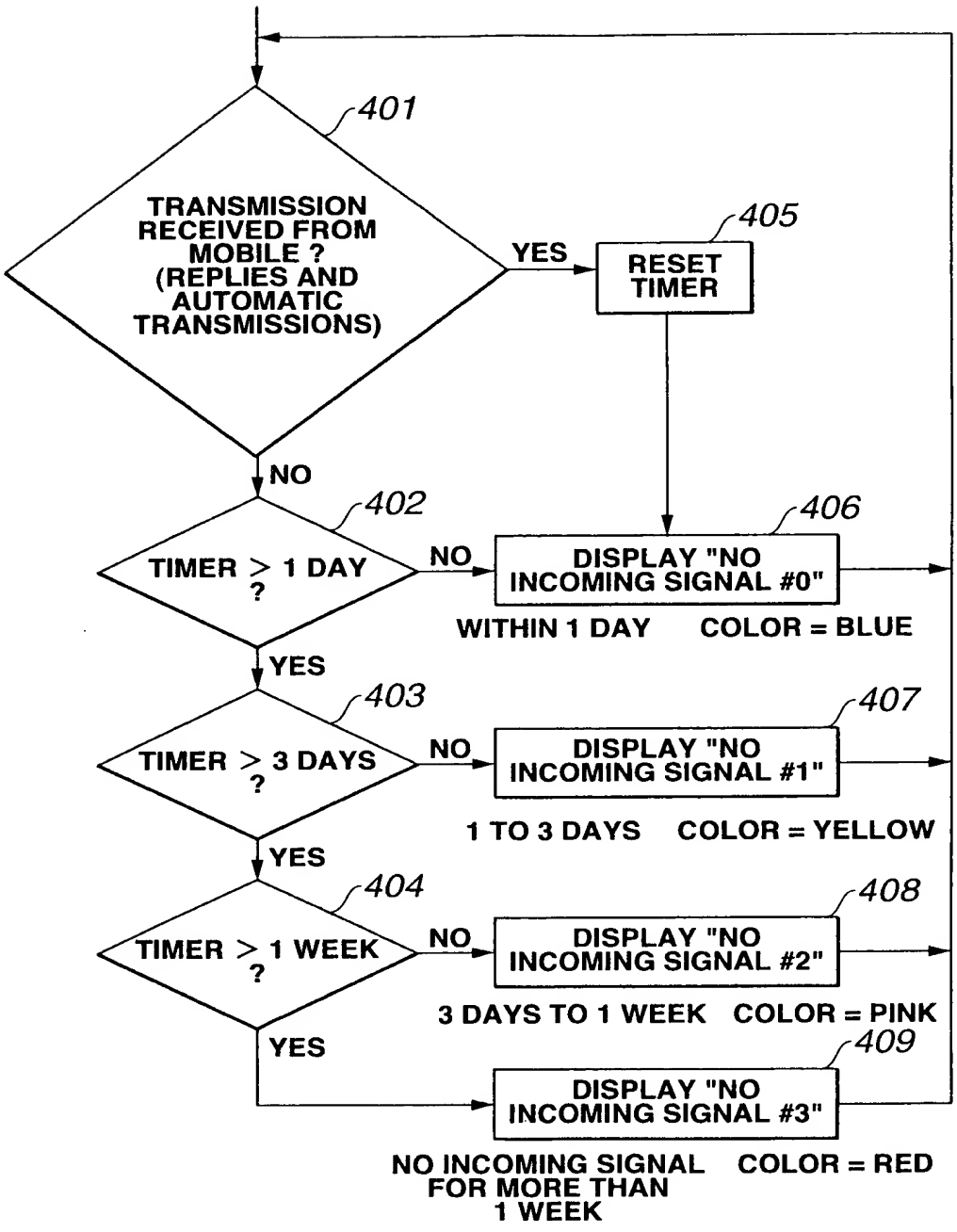

401
TRANSMISSION RECEIVED FROM MOBILE ? (REPLIES AND AUTOMATIC TRANSMISSIONS)
YES
405
RESET TIMER
NO
402
TIMER > 1 DAY ?
NO
406
DISPLAY "NO INCOMING SIGNAL #0"
WITHIN 1 DAY COLOR = BLUE
YES
403
TIMER > 3 DAYS ?
NO
407
DISPLAY "NO INCOMING SIGNAL #1"
1 TO 3 DAYS COLOR = YELLOW
YES
404
TIMER > 1 WEEK ?
NO
408
DISPLAY "NO INCOMING SIGNAL #2"
3 DAYS TO 1 WEEK COLOR = PINK
YES
409
DISPLAY "NO INCOMING SIGNAL #3"
NO INCOMING SIGNAL FOR MORE THAN 1 WEEK COLOR = RED

FIG.19

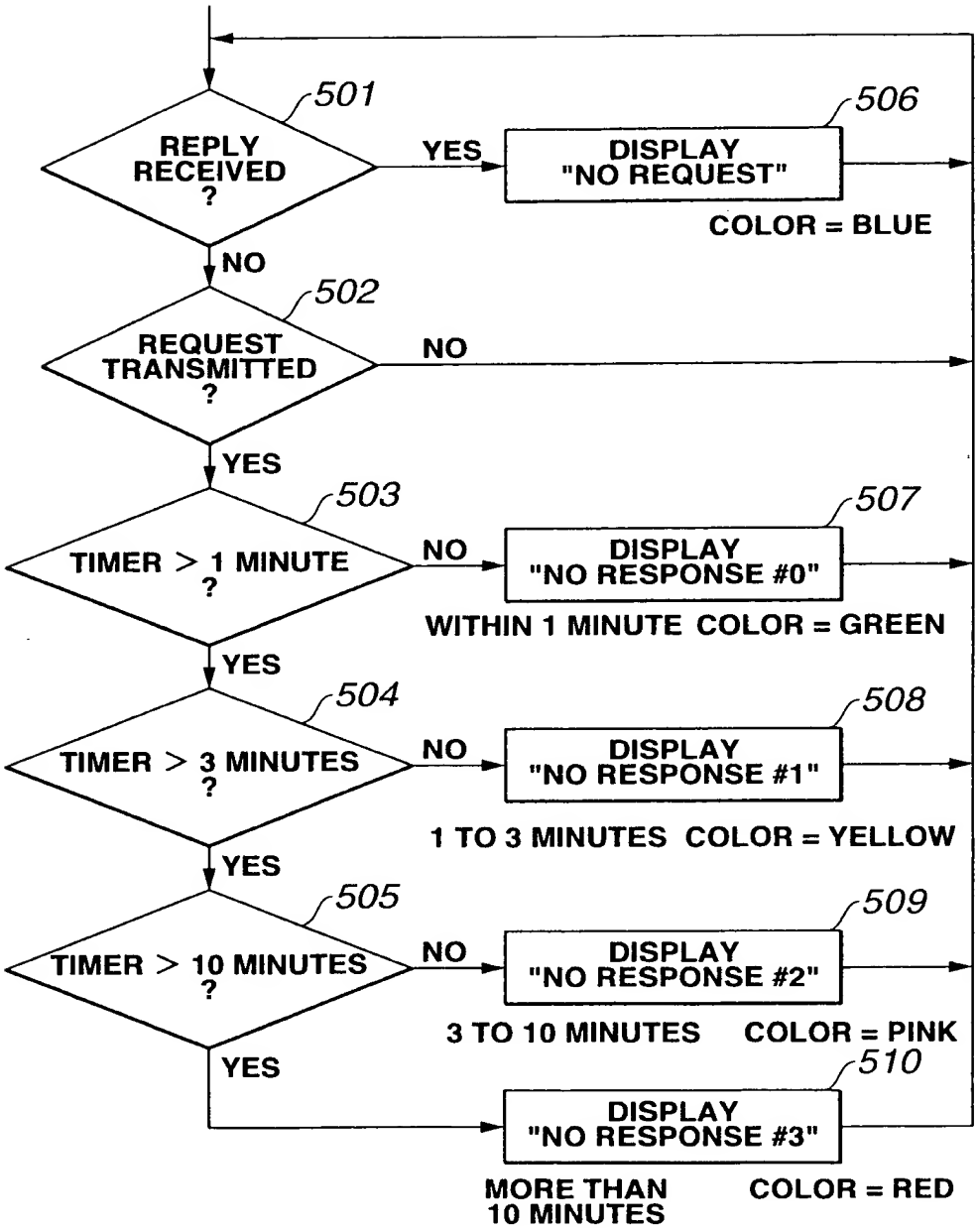

501
REPLY RECEIVED ?
YES
506
DISPLAY "NO REQUEST"
COLOR = BLUE
NO
502
REQUEST TRANSMITTED ?
NO
YES
503
TIMER > 1 MINUTE ?
NO
507
DISPLAY "NO RESPONSE #0"
WITHIN 1 MINUTE COLOR = GREEN
YES
504
TIMER > 3 MINUTES ?
NO
508
DISPLAY "NO RESPONSE #1"
1 TO 3 MINUTES COLOR = YELLOW
YES
505
TIMER > 10 MINUTES ?
NO
509
DISPLAY "NO RESPONSE #2"
3 TO 10 MINUTES COLOR = PINK
YES
510
DISPLAY "NO RESPONSE #3"
MORE THAN 10 MINUTES
COLOR = RED

FIG.20

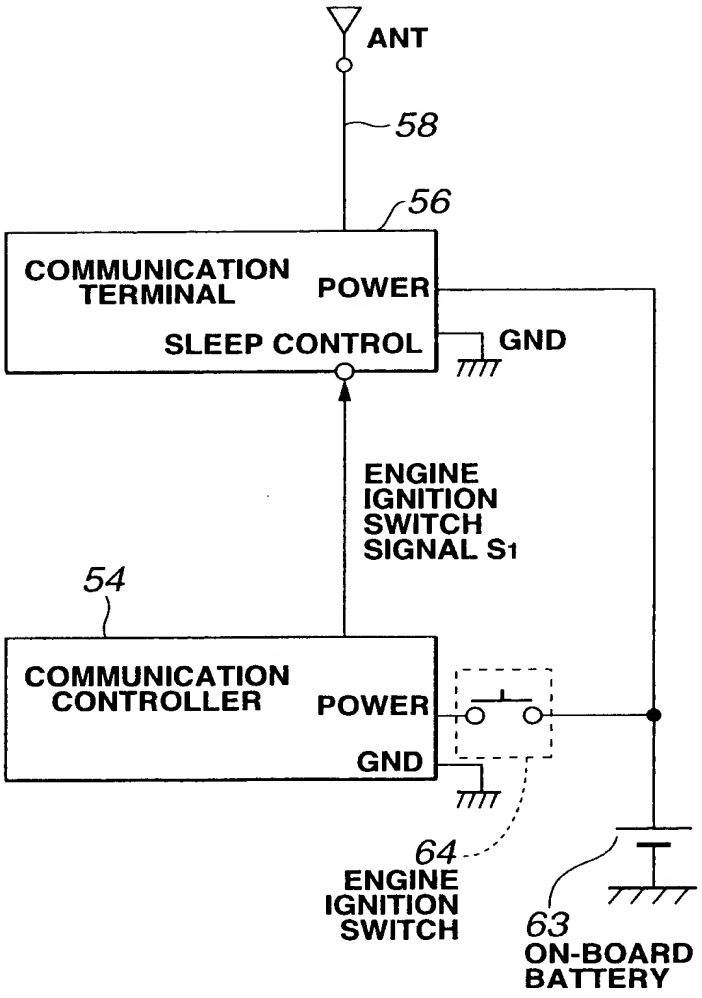

ANT
58
56
COMMUNICATION TERMINAL
POWER
SLEEP CONTROL
GND
ENGINE IGNITION SWITCH SIGNAL S1
54
COMMUNICATION CONTROLLER
POWER
GND
64
ENGINE IGNITION SWITCH
63
ON-BOARD BATTERY

FIG.21

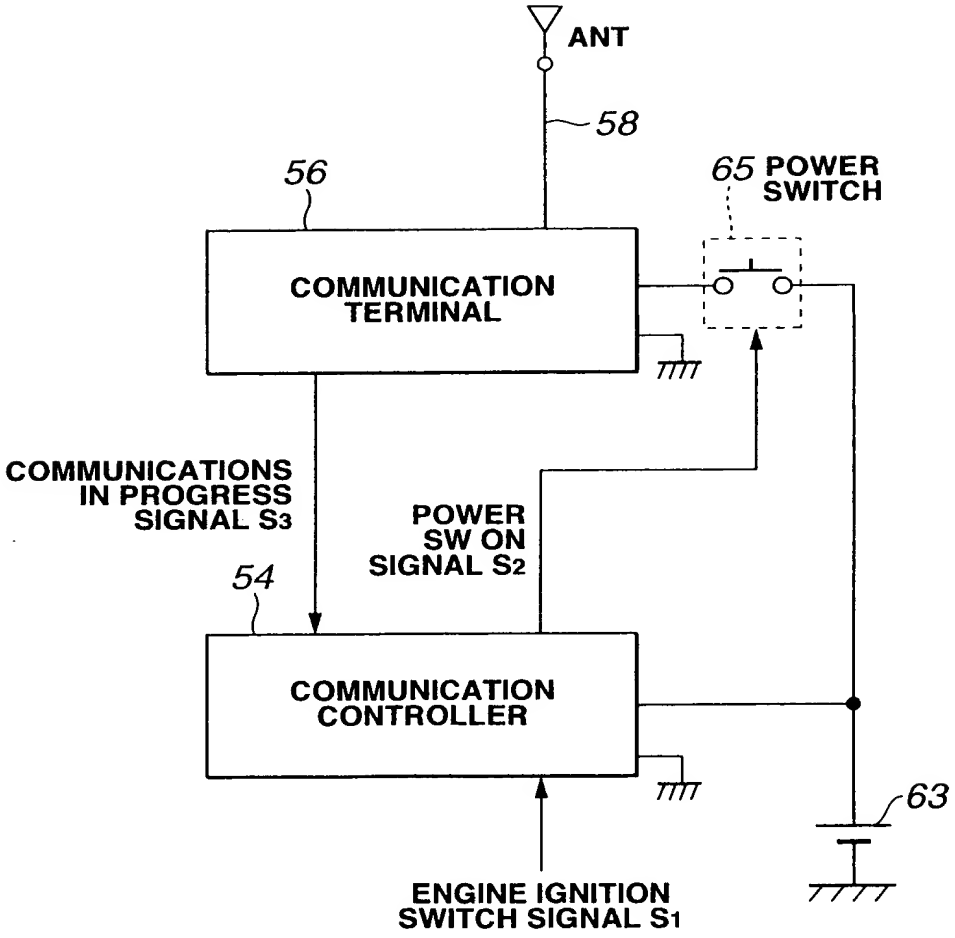

ANT
58
56
65 POWER SWITCH
COMMUNICATION TERMINAL
COMMUNICATIONS IN PROGRESS SIGNAL S3
POWER SW ON SIGNAL S2
54
COMMUNICATION CONTROLLER
63
ENGINE IGNITION SWITCH SIGNAL S1

FIG.22

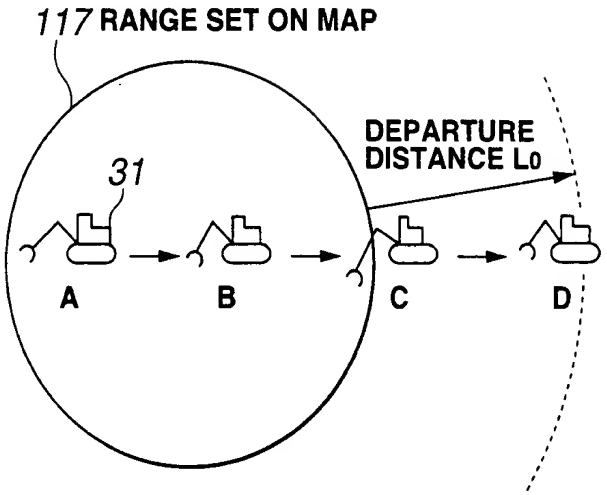


FIG.23(a)

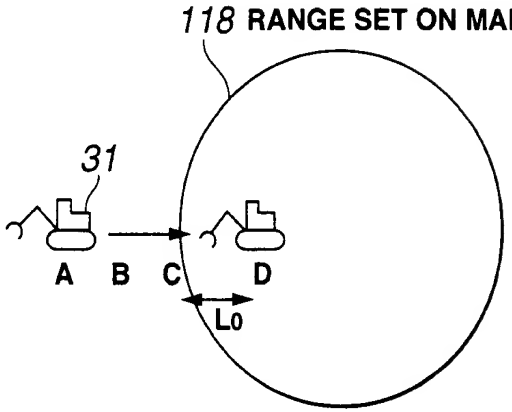


FIG.23(b)

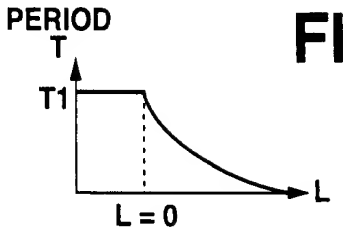


FIG.23(c)

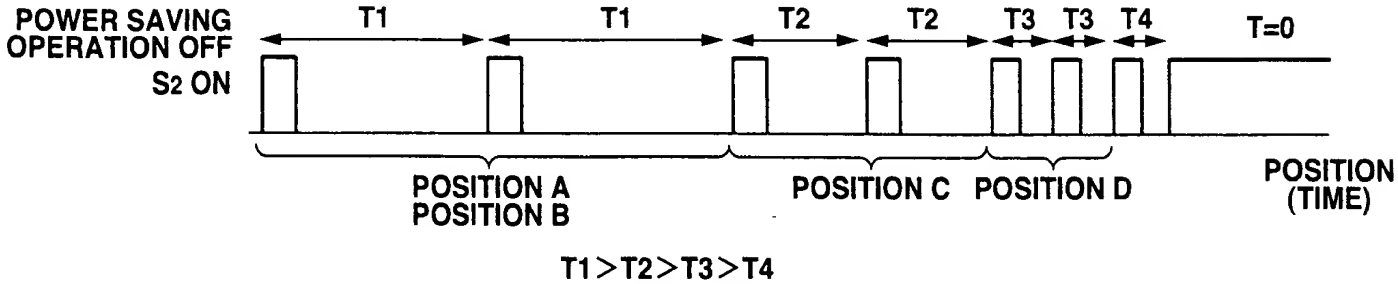


FIG.23(d)

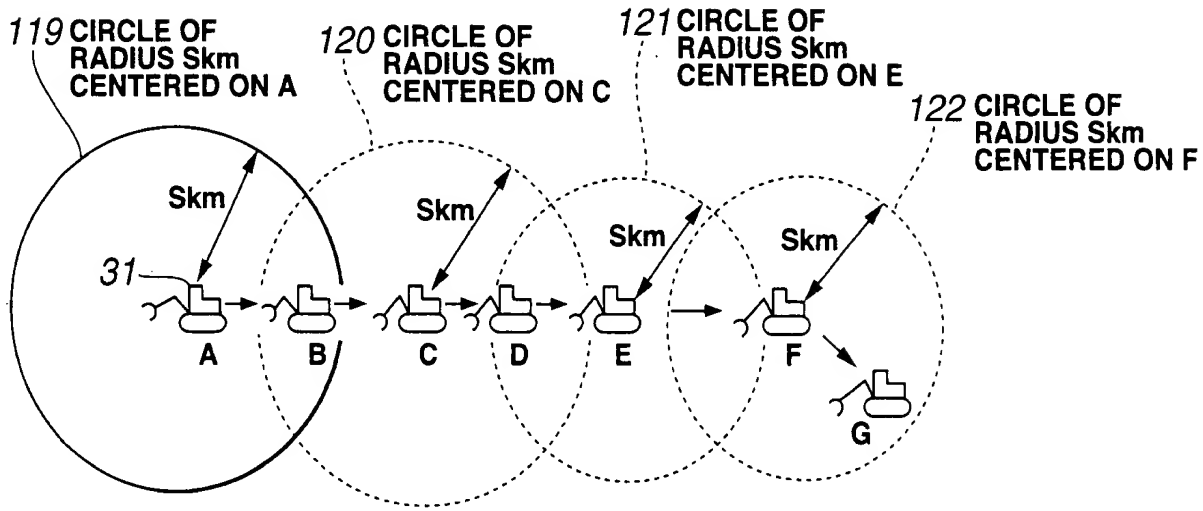
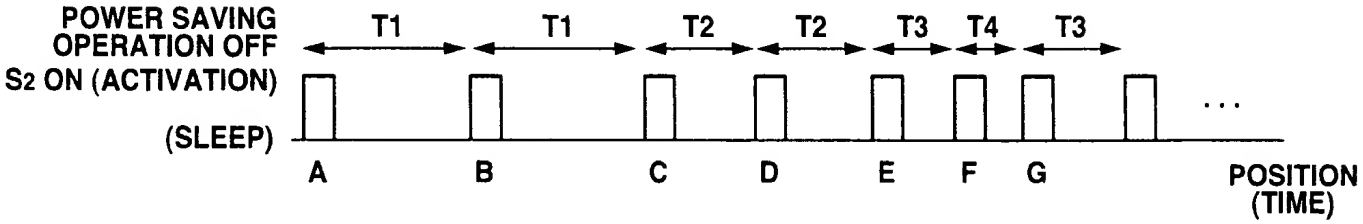


FIG.24(a)



T1>T2>T3>T4

FIG.24(b)

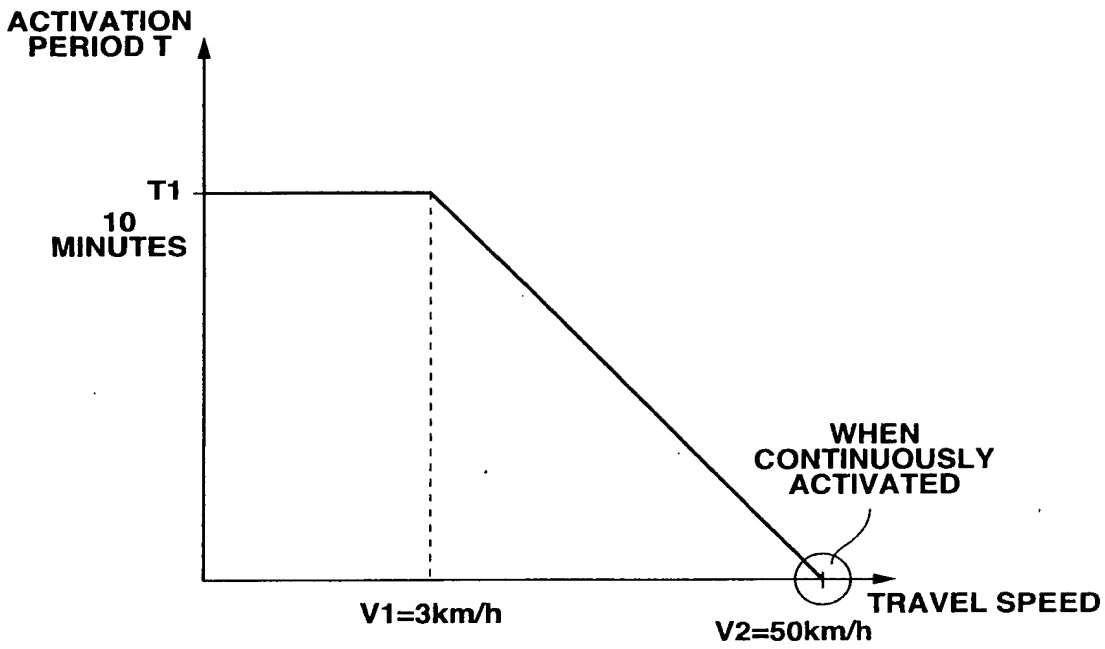

ACTIVATION PERIOD T
T1
10 MINUTES
WHEN CONTINUOUSLY ACTIVATED
TRAVEL SPEED
V1=3km/h
V2=50km/h

FIG.25

FIG.26(a) ENGINE RUNNING CONDITION

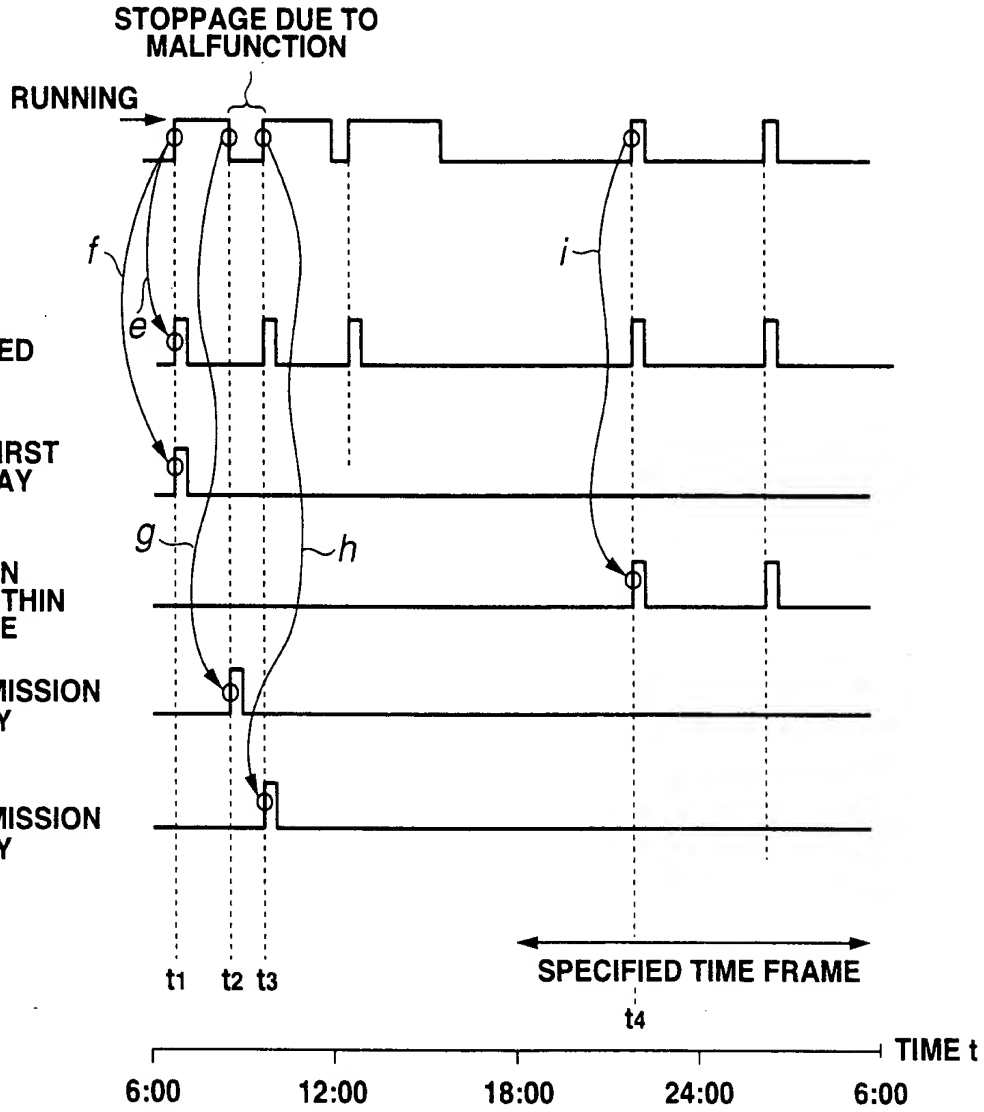
FIG.26(b) AUTOMATIC TRANSMISSION WHEN ENGINE STARED

FIG.26(c) AUTOMATIC TRANSMISSION AT FIRST ENGINE START OF DAY

FIG.26(d) AUTOMATIC TRANSMISSION WHEN ENGINE STARTED WITHIN CERTAIN TIME FRAME

FIG.26(e) AUTOMATIC TRANSMISSION WHEN ABNORMALITY DETECTED

FIG.26(f) AUTOMATIC TRANSMISSION WHEN ABNORMALITY ELIMINATED



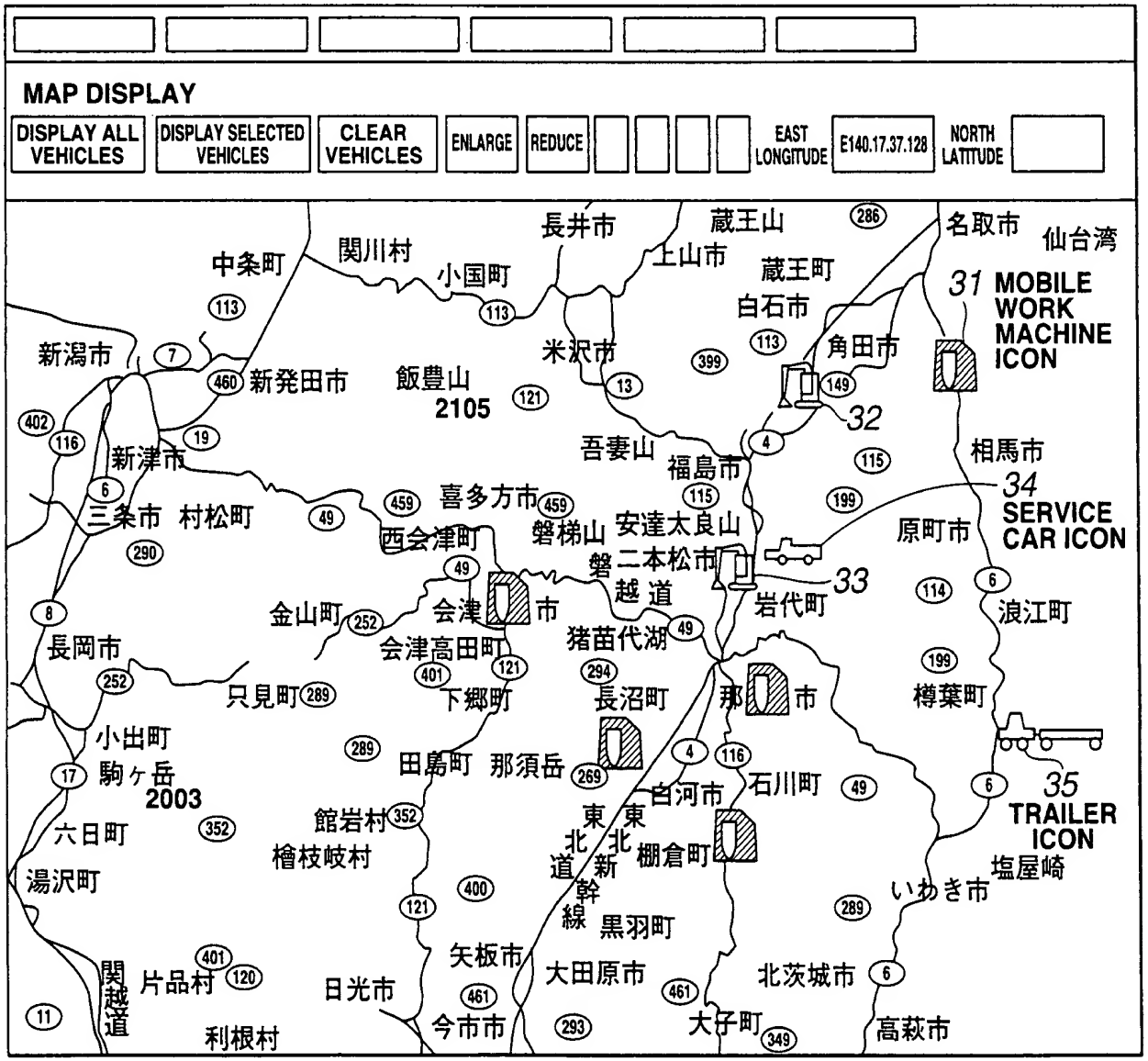

MAP DISPLAY
DISPLAY ALL VEHICLES
DISPLAY SELECTED VEHICLES
CLEAR VEHICLES
ENLARGE
REDUCE
EAST LONGITUDE
E140.17.37.128
NORTH LATITUDE
31 MOBILE WORK MACHINE ICON
32
34 SERVICE CAR ICON
33
35 TRAILER ICON
2105
2003
長井市
蔵王山
名取市
仙台湾
中条町
関川村
小国町
上山市
蔵王町
白石市
新潟市
新発田市
飯豊山
米沢市
角田市
吾妻山
福島市
相馬市
新津市
三条市
村松町
喜多方市
安達太良山
原町市
西会津町
磐梯山
磐二本松市
越道
岩代町
浪江町
金山町
会津
市
猪苗代湖
長岡市
会津高田町
只見町
下郷町
長沼町
那
市
樽葉町
小出町
田島町
那須岳
白河市
石川町
駒ヶ岳
館岩村
東北新幹線
棚倉町
六日町
檜枝岐村
塩屋崎
湯沢町
いわき市
黒羽町
関越道
片品村
矢板市
大田原市
北茨城市
日光市
今市市
大子町
高萩市
利根村

FIG.27

DATA BY VEHICLE MODEL : LATEST DATA RETURN

POSITION DATA : HISTORY

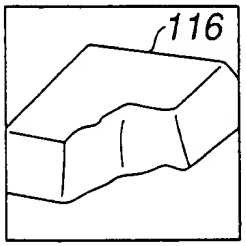
DATE	LATITUDE	LONGITUDE
98/10/19 3:58:30 P.M.	H35.19.15.240	E139.17.54.210

SERVICE METER	98/10/19 3:58:30 P.M.		GRAPH

SPECIFIC DATA

FUEL QUANTITY	98/09/10 5:06:38 P.M.	90	%	GRAPH
ENGINE SPEED	98/09/10 5:06:38 P.M.	1340	RPM	GRAPH
BATTERY VOLTAGE	98/09/10 5:06:38 P.M.	26	V	GRAPH
PUMP PRESSURE	98/09/10 5:06:38 P.M.	35	kg/cm²	GRAPH
WORK MODE	98/09/10 5:06:38 P.M.			

IMAGE CAPTURED BY CAMERA



RUNNING MAP GRAPH

FIG.28

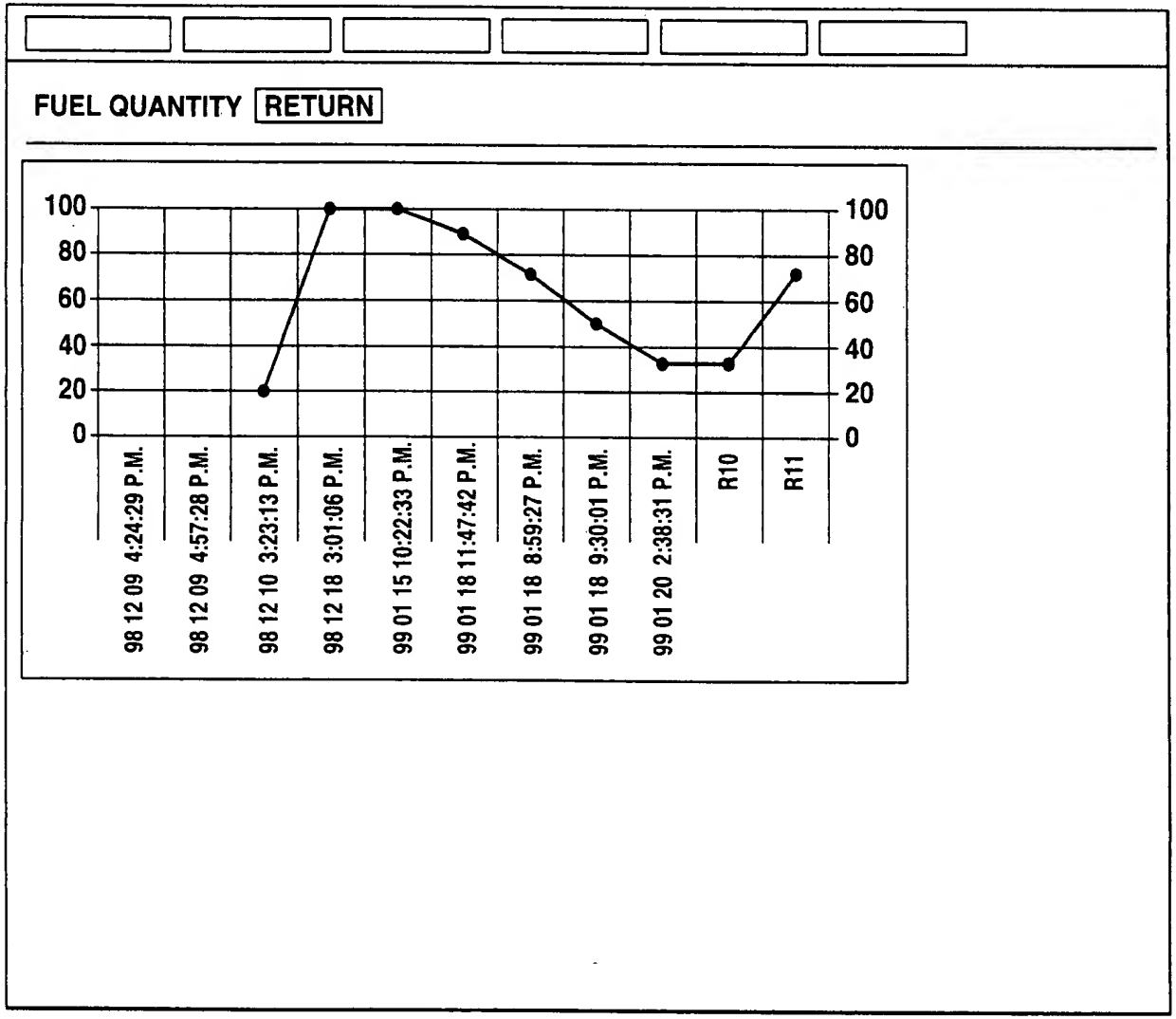

FUEL QUANTITY
RETURN
100
80
60
40
20
0
98 12 09 4:24:29 P.M.
98 12 09 4:57:28 P.M.
98 12 10 3:23:13 P.M.
98 12 18 3:01:06 P.M.
99 01 15 10:22:33 P.M.
99 01 18 11:47:42 P.M.
99 01 18 8:59:27 P.M.
99 01 18 9:30:01 P.M.
99 01 20 2:38:31 P.M.
R10
R11

FIG.29

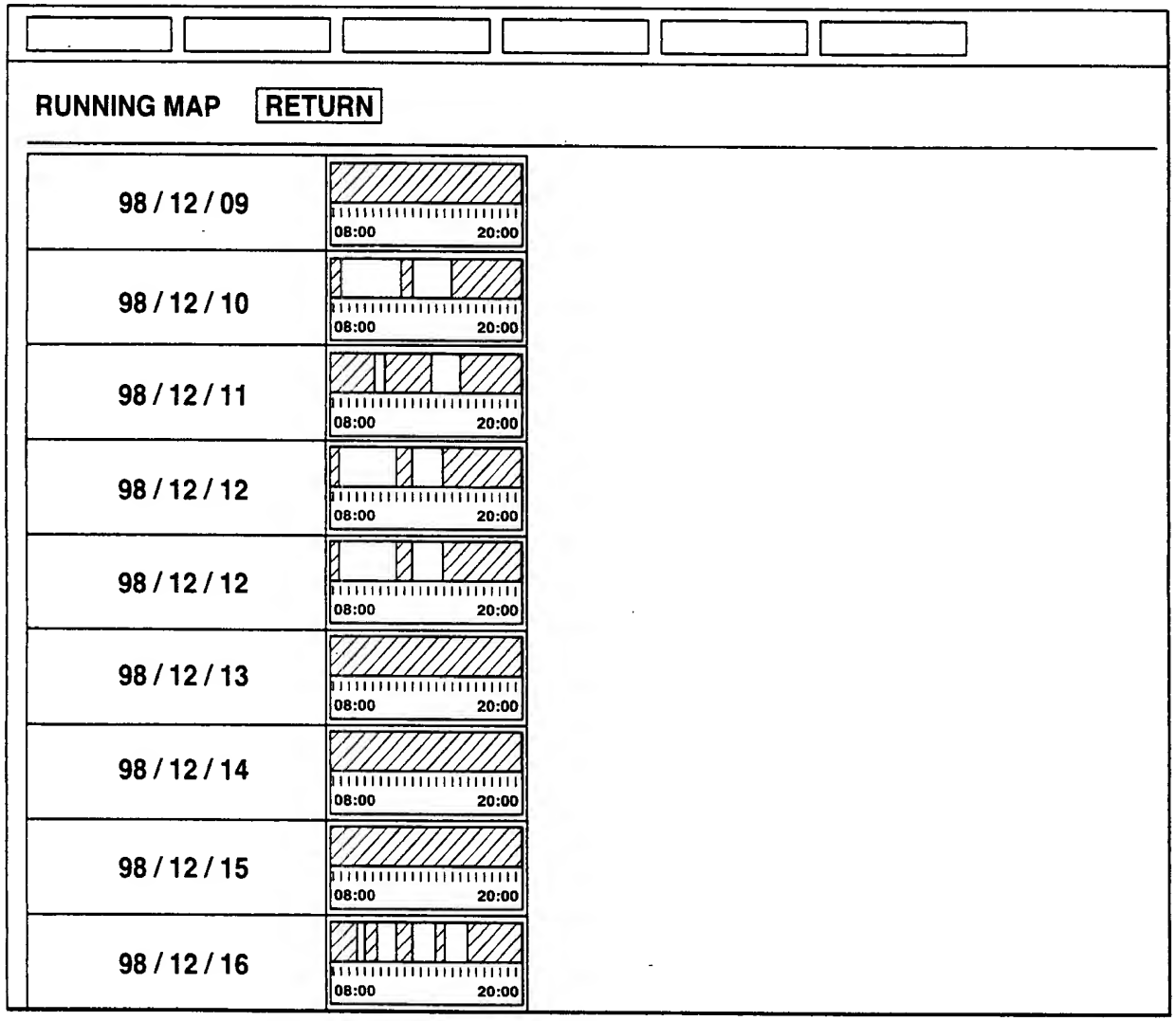
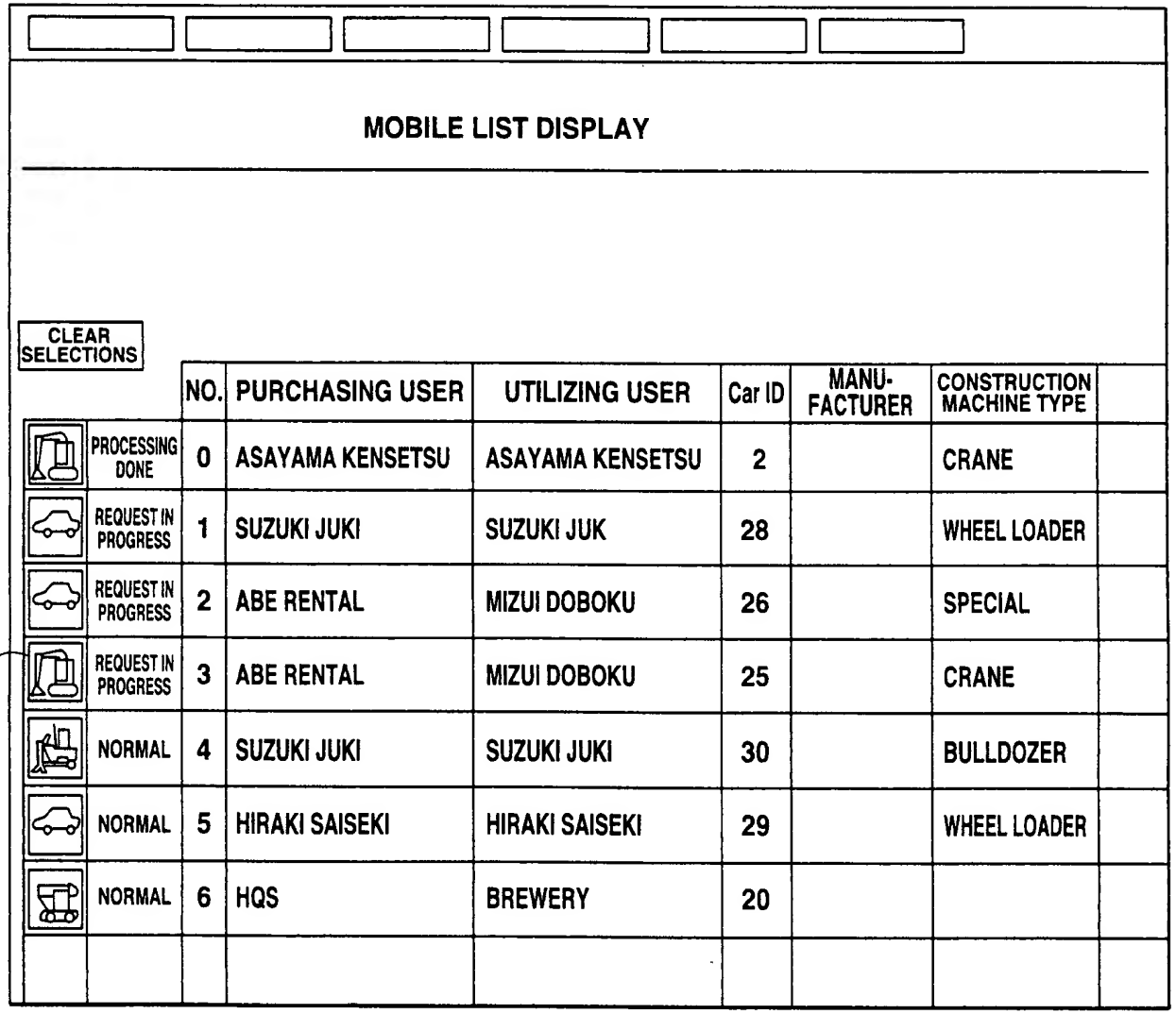
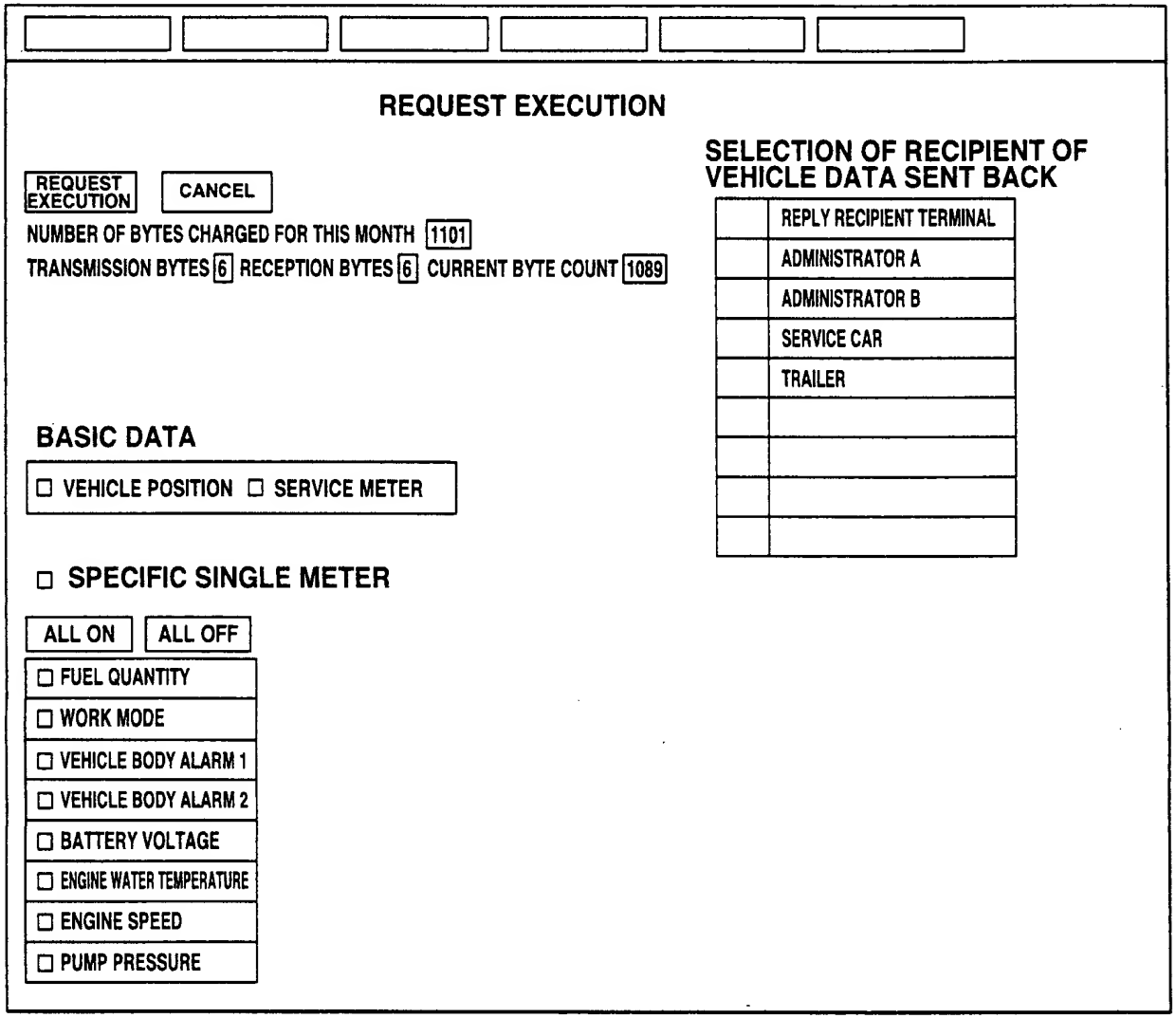

RUNNING MAP
RETURN
98 / 12 / 09
08:00
20:00
98 / 12 / 10
08:00
20:00
98 / 12 / 11
08:00
20:00
98 / 12 / 12
08:00
20:00
98 / 12 / 12
08:00
20:00
98 / 12 / 13
08:00
20:00
98 / 12 / 14
08:00
20:00
98 / 12 / 15
08:00
20:00
98 / 12 / 16
08:00
20:00

FIG.30



	NO.	PURCHASING USER	UTILIZING USER	Car ID	MANU-FACTURER	CONSTRUCTION MACHINE TYPE	
PROCESSING DONE	0	ASAYAMA KENSETSU	ASAYAMA KENSETSU	2		CRANE	
REQUEST IN PROGRESS	1	SUZUKI JUKI	SUZUKI JUK	28		WHEEL LOADER	
REQUEST IN PROGRESS	2	ABE RENTAL	MIZUI DOBOKU	26		SPECIAL	
REQUEST IN PROGRESS	3	ABE RENTAL	MIZUI DOBOKU	25		CRANE	
NORMAL	4	SUZUKI JUKI	SUZUKI JUKI	30		BULLDOZER	
NORMAL	5	HIRAKI SAISEKI	HIRAKI SAISEKI	29		WHEEL LOADER	
NORMAL	6	HQS	BREWERY	20			

FIG.31



EXAMPLE OF SCREEN FOR MAKING INFORMATION REQUEST TO MOBILES

FIG.32

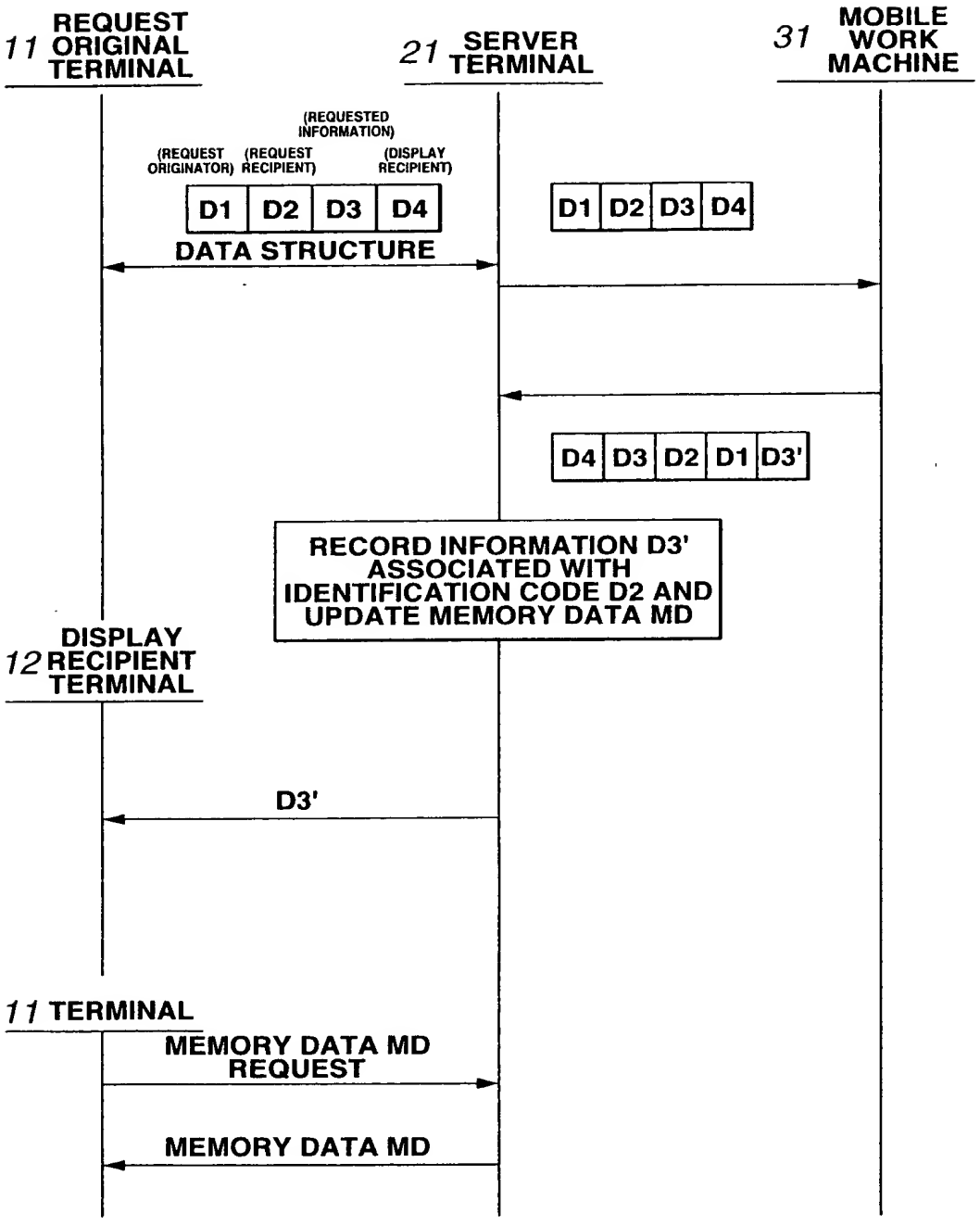

11 REQUEST ORIGINAL TERMINAL
21 SERVER TERMINAL
31 MOBILE WORK MACHINE
(REQUESTED INFORMATION)
(REQUEST ORIGINATOR)
(REQUEST RECIPIENT)
(DISPLAY RECIPIENT)
D1 D2 D3 D4
DATA STRUCTURE
D1 D2 D3 D4
D4 D3 D2 D1 D3'
RECORD INFORMATION D3' ASSOCIATED WITH IDENTIFICATION CODE D2 AND UPDATE MEMORY DATA MD
12 DISPLAY RECIPIENT TERMINAL
D3'
11 TERMINAL
MEMORY DATA MD REQUEST
MEMORY DATA MD

FIG.33